INTER AVIA

Review of World Aviation

In this Issue :

Pan Am Attacks

C. G. Grey : The British Aircraft Industry (Hawker-Siddeley Group)

ATAR 101 B Turbo-Jet—Crack-Up at 500 m.p.h.—Boeing's Baby Turbine—"Aerobee" Rocket

W. M. Horten : Powered Sailplanes — Freight Soars

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Coming in over Rio de Janeiro (see page 329).

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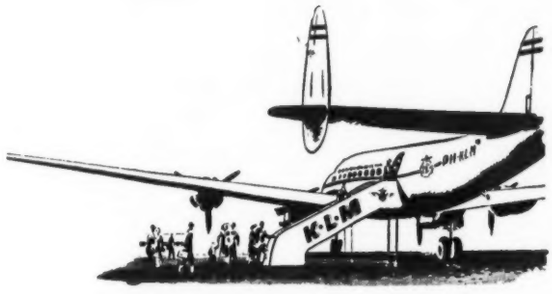
In the air



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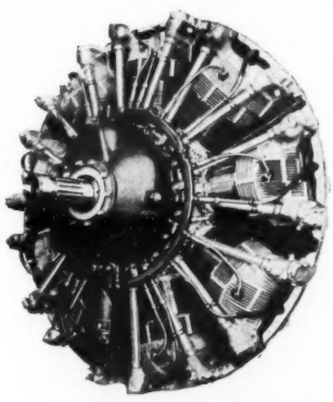

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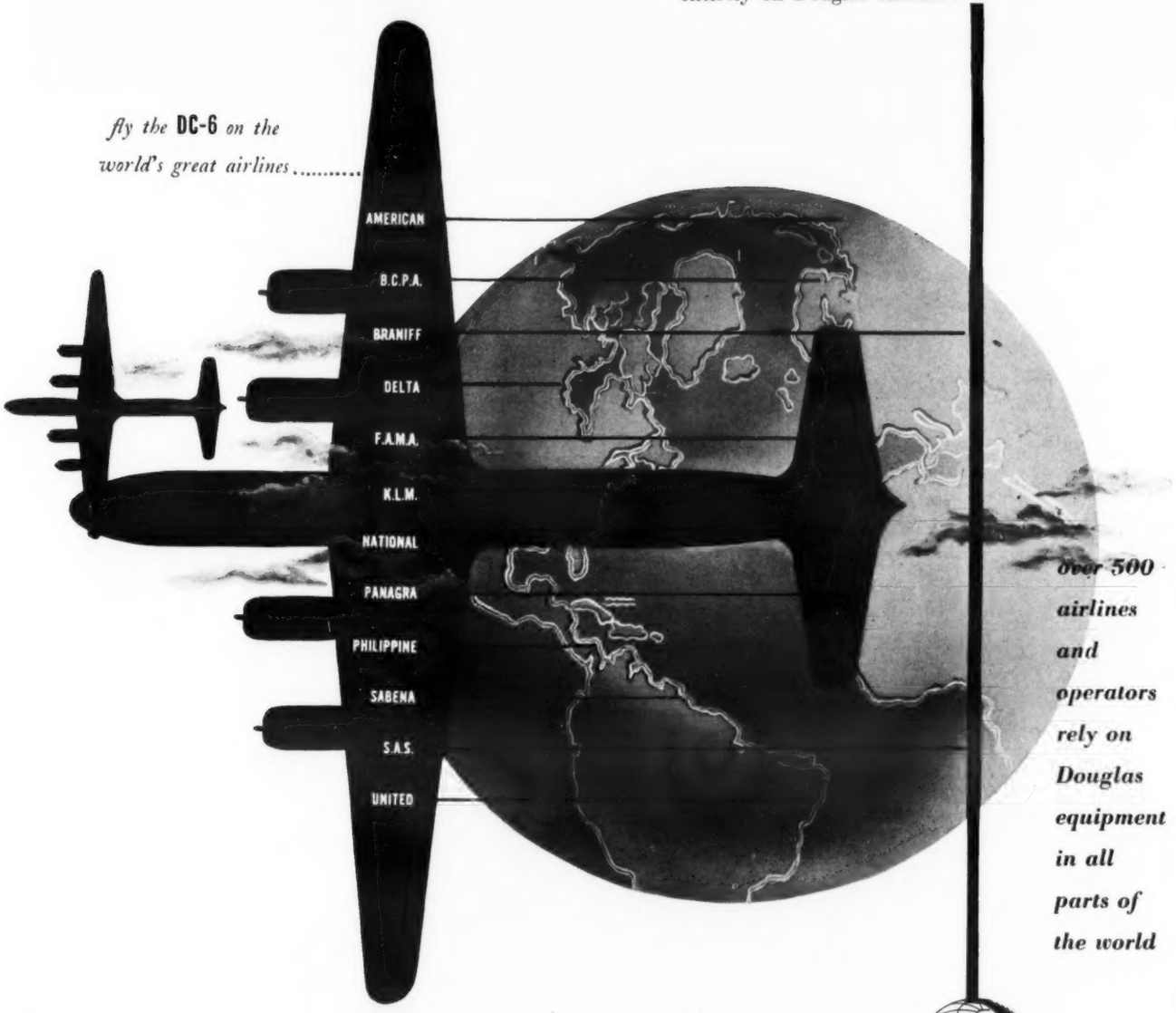

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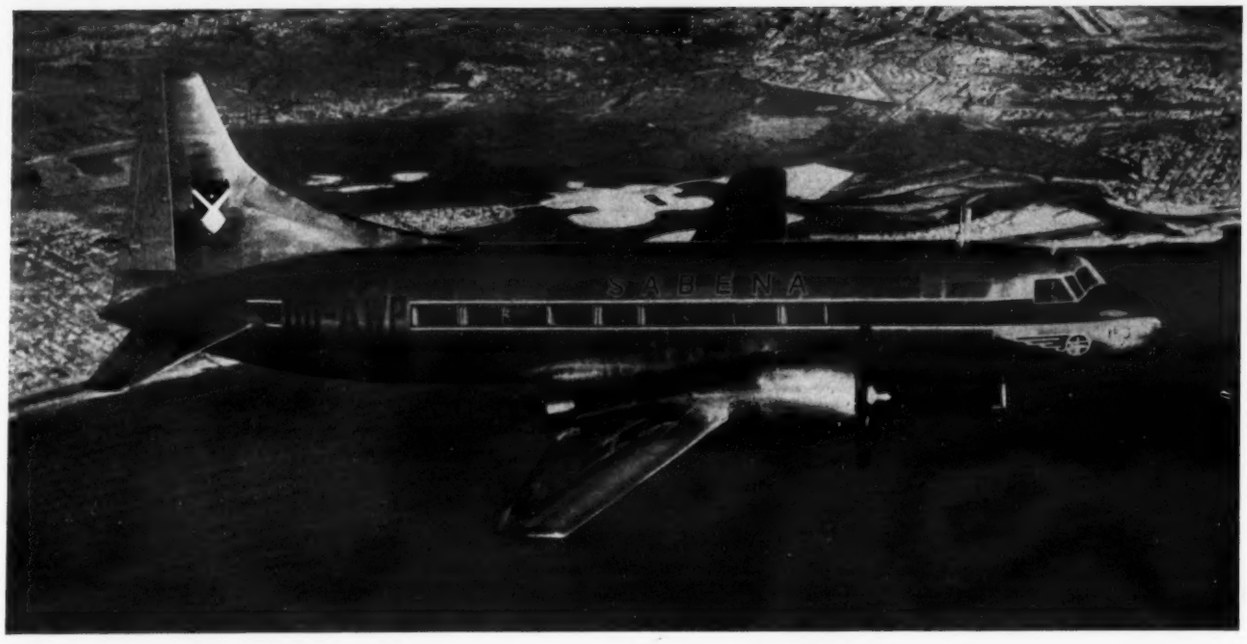

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Flying boats in South America

ALFA's Sandringhams

Aviacion del Litoral Fluvial Argentino has recently ordered two more of the roomy Sandringhams for its services based on Buenos Aires. The use of a 60,000lb. aircraft has proved surprisingly satisfactory and economical over short hauls in difficult country. Travelling is not easy round the estuary of La Plata. By train and steamer it takes about 24 hours to make the journey from Buenos Aires to Montevideo.

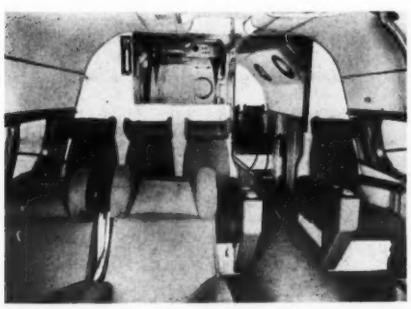
ALFA's Sandringhams reduce this time by roughly 23 hours, which is the reason why 90 per cent of their seats are occupied every trip. Between Buenos Aires and Montevideo, for example, the flying boats carry about 30,000 passengers a year.

They are on regular daily services along the Plata and the Parana Rivers, from Buenos Aires to Rosario, to Posadas, and to Asuncion in Paraguay.

In effect, this is an inland service operating from a coastal base, like that of the Short Solents which B.O.A.C. uses on its Springbok route from Southampton to Johannesburg.

Luxury Coach . . .

Around "B.A." the current word for the comfort of the Sandringham is 'simpatico.' When Shorts developed this boat from the historic Sunderland, they were careful to allow for a variety of interior arrangements. ALFA's Sandringhams have room for 51 passengers in conditions of great individual comfort. The service fills a long-felt want, and many satisfied passengers have learnt that 'it's fun to fly by flying boat.'



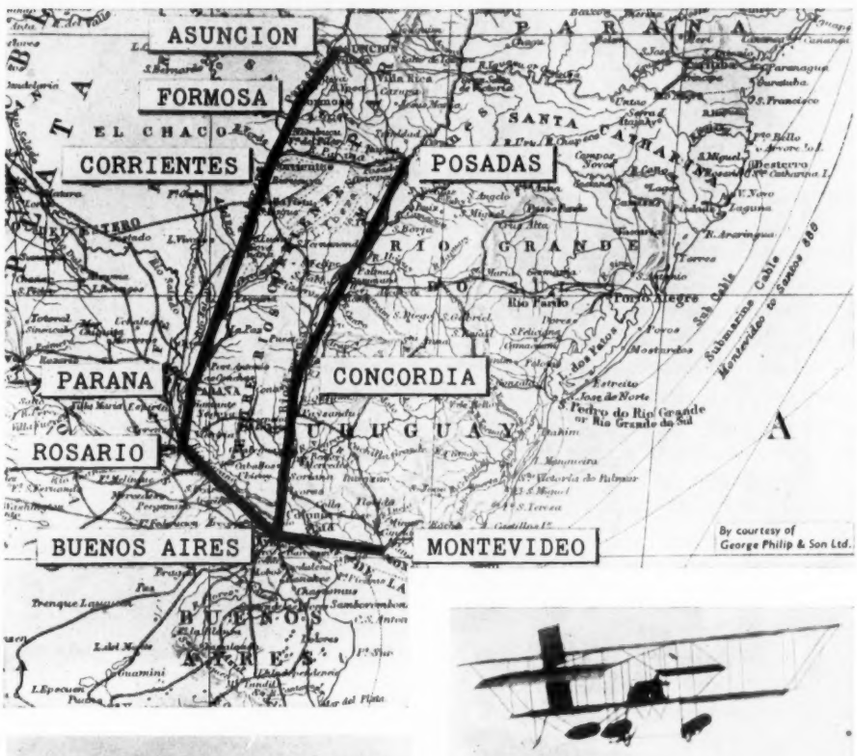
The spacious interior of the Mk. III Sandringham. ALFA will operate its latest boats as 51-seaters, replacing the cocktail bar by a pantry.

. . . or private bus?

Perhaps the need is for a more modest aircraft. Short's answer to the problems of feeder lines is the amphibian Sealand.

The estate manager or plantation owner is often faced with the difficulty of an extended line of communications; he may have districts under his control which are inaccessible by overland routes.

But if there are rivers or lakes in the area the Sealand is in its element. It needs only 550 yards of water for a take-off. And its range



From land the amphibian Sealand takes off in 430 yards. If it is used as a flying boat pure and simple, the payload, with full tanks, can be increased by 1,000lb.

is elastic. At a payload of 1,400lb. — which is equivalent to seven passengers and baggage— the Sealand can cover 350 miles at 150 m.p.h. With less payload the range can be greatly extended.

The petrol consumption is better than 6 air miles per gallon, and the Sealand has a low operating cost when used as a bus or a general hold-all for stores of various kinds.

B.W.I.A. have acquired three Sealands for work among the West Indian Islands. Why not follow their example and let Shorts adapt the Sealand to your requirements?

A Short Pusher biplane was the first aircraft to take off from the deck of a ship. The Sturgeon is Short's latest contribution to the history of naval aviation.

Another Chapter

It is 37 years since Comdr. Samson in a Short Pusher biplane made his historic first flight from the deck of H.M.S. "Africa." The latest landmark in the history of Short's contributions to naval aviation is the arrival of the Sturgeon. This is the first twin-engined carrier-borne aircraft specially designed to naval specifications. The Sturgeon possesses great speed and power, and is suitable for long range photographic reconnaissance or bombing operations—its latest role being that of a high-speed target tower.

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All Quiet on the Western Front—On the Eastern, Too

"Now the world is every man's oyster"

Tears came to my eyes . . . Or was it merely the moisture which, under Brazil's scorching sun, broke out of every pore ?

I had just finished reading a touching story about a good and noble man—a true idealist and public benefactor.

Juan T. Trippe, President of Pan American World Airways, had always been a great man in my eyes. Only lately I wrote that he had made his mark and his story would go down in the annals of aviation history. But I was to discover certain traits entirely new to me.

It was in Rio de Janeiro at the end of last March that an acquaintance closely associated with P.A.A. handed me, with a significant smile, the weekly U.S. news magazine, *Time*, of March 28th, which had just arrived by airmail. The front cover carried a picture of Pan American's Juan Trippe, captioned "Now the world is every man's oyster," and the "Business and Finance" section contained no less than twelve columns of text and illustrations devoted to Trippe and his career.

It was written how the "Clipper Skipper," the absolute boss of the world's biggest airline company, now hopes to revolutionise air travel, not only for P.A.A. but for civil aviation in general, with his new Boeing "Stratocruisers." Now that he has conquered time, Trippe hopes to conquer the other prison-keeper of the average man—money. The present New York—London round trip fare of $630 Trippe aims ultimately to cut down to $200. And the world is talking of a crisis in civil aviation !

In order to accommodate this futuristic airborne migration of peoples, Trippe, through P.A.A.'s Intercontinental Hotels Corporation, is promoting a chain of hotels throughout the world—in Central and South America, later in Europe, the Middle East, Africa, and elsewhere—each hotel costing between five and ten million dollars. While in Uruguay's capital, Montevideo, I was able to see with my own eyes one of these skyscraper-type buildings nearing completion. There, it appears, the Argentine shipping magnate, Dodero —who also has interests in aviation—is partnering Trippe and Pan Am. And it looks as though Dodero's participation was well thought over, for Montevideo's beach is a favourite summer resort of Argentines.

But let us return to Trippe, as seen through the eyes of *Time* magazine.

Erect, well-knit and six-foot tall, Trippe runs his airline, and does his "secret dreaming," from a modest headquarters on the 58th floor of the Chrysler Building in New York. Indefatigable, and a loyal friend, Trippe, surrounded by former schoolmates (for example, Cornelius Vanderbilt Whitney and Samuel F. Pryor) built up his company—from nothing, so to speak, and figuratively with his own hands—into the representative company of U.S. overseas civil aviation and the biggest air carrier in the world. In good time he established branch and subsidiary companies in order to cover entire continents. In 1930, he came to an agreement with Britain's former Imperial Airways for landing rights so that P.A.A. could fly the North Atlantic. He agreed to wait until the British were ready with their flying equipment, but by 1934, when he was ready and the British were not, he decided to fly the Pacific instead. This led to his first friction with a competitor, that time the British. Just before the outbreak of World War II, the network of Pan Am and its subsidiaries embraced the Pacific, North and South Atlantic. War broke out at a time when P.A.A. possessed the foundations of a global network.

And, in reality, the second world war brought with it the decisive rise of the company. Right after Pearl Harbour, Pan Am became a major part of the U.S. military machine as one of its main trans-ocean transport systems—naturally under Trippe's leadership. Under contract to the U.S. Army and Navy, P.A.A.'s employee roster grew from 4,395 to 88,000 personnel, and the carrier was responsible for the building of 53 airports abroad.

Time cautiously recalls the complaints raised by the Army and Navy that P.A.A.'s expenses were too high and its crews were not flying with the desirable amount of care. But such objections were soon quashed by friends in Washington. And, incidentally, no one can deny that Pan American Airways rendered invaluable service to the U.S. war effort.

One of Trippe's strong points lies in his well-organised staff, the members of which

Pan American World Airways, a valued (dollar) customer of the aircraft industry. P.A.A. President Juan T. Trippe, during his tour of the Boeing plant at Seattle, where he bought 20 "Stratocruisers," views a test run of the small Model 500 turbojet. Left to right are Wellwood E. Beall, Boeing Vice-President for Engineering and Sales; Trippe; David Ingalls, P. A. A. Vice-President; and William M. Allen, Boeing's President.

do not only sit around the head office, but also maintain connection with U.S. domestic and foreign politics. That is how he plays his game, and so far there would be nothing to complain against.

But now something peculiar arises.

Presumably wishing to bring the recently much-publicised and disputed name of Juan T. Trippe closer to the public and to make him appear human, Pan Am's public relations service handed over to *Time's* reporter private details and family photos of the carrier's president, which must make a rather odd impression on the uninitiated.

Who can be interested in how Mr. Trippe organises his private life ? Who wants to know how Mr. Trippe—surrounded by his wife and four children—spends his evenings, where and how he lives, what he does at weekends, what he earns and possesses ? What significance have such figures, what purpose do they serve ?

That a man who, in a little less than twenty years, has built up a world organisation, does not run short of money himself, is obvious to everybody. That a 49-year-old man has not yet fulfilled his every wish and not yet satisfied his last ambition, is clear to all. The only question which might arise is where this ambition is to lead him and where its limits lie.

For this touching family man, this public benefactor and mystic planner is—up to the present, at least—not only an extraordinarily energetic person, but also a no less lucky and ruthless competitor.

Pan Am's financial report ? It does not differ from that of any other well-run business. It appears quite normal that, on nearly $150 million worth of business, the company can estimate its 1948 net income at a little more than $4.5 million. It appears quite normal, but is surprising, nevertheless ; for other U.S. carriers were likewise able to net a gross income of about $100 million, but all the same lost a few millions during the same period. During 1948, almost all the large, medium and small airline companies of the world fought to keep alive ; almost without exception, they suffered losses which could not be attributed to the presence of simpletons or adventurers at the helm.

Is it not odd that Pan Am is always in the front rank when the question of fare cuts arises, and that it always manages to keep in the black ? Is it not truly astonishing that, at a time of crisis in international civil aviation, Trippe can contemplate cutting the present North Atlantic fares by over two thirds, whereas other air carriers can hardly balance their budgets with the present prices ? Does not such a tariff battle reveal a spirit of pitiless competition, a tendency to bring the airline crisis to boiling point ?

How is it possible that Pan Am always has sufficient ready cash to purchase new and expensive airliners, whilst other companies have to renounce any idea of acquiring new flying equipment, or are compelled to seek assistance from banks, insurance companies and, as last resort, the Government ?

Where do the means come from—we might ask further—with which P.A.A. can again and again take over, or bid for, parts of competitive or complementary companies ?

Finally, how is it that Pan Am can envisage shouldering the financial risk of rounding off its global network by opening U.S. inland routes ?

No answer to such questions is given by *Time,* despite the article's being under the heading "Business and Finance." But many a reader might be more interested in answers to these questions than P.A.A.'s attempt to bring tears to the public's eyes by portraying Juan T. Trippe as a man of the people.

Let us stick to the point !

Pan Am's president is doubtlessly an exceptionally gifted organiser and businessman. Continued success can be brought about only by diligence, and Trippe has long been successful. Successful in the choice of his colleagues, successful in his dealings with domestic and foreign politics. A man of great ability and a man with excellent connections.

Backed by these connections, Trippe was early to specialise in a domain which, in the grey prewar era, was a mystery except to very few. The only exceptions were the major airline companies of Great Britain, France, Holland and one-time Germany. Others dared not contemplate such plans.

Trippe was one of the first to specialise in real long-range traffic, connecting continents. He was not content to abide by the hackneyed concept that the aircraft was a faster mode of transportation. He believed in the possibility of increasing the aircraft's range. In this respect, too, he was a pioneer. And he possessed further qualities. If he made mistakes—he or his entourage—he did not let himself be bound by them. It is only a few years ago that he, his staff and a number of manufacturers, believed that flying-boats were the only answer to overseas operations. But he was the first to commit his flying-boat fleet to the scrap-heap in favour of up-to-date landplanes. Thus, at the present moment, the "Stratocruiser" is his *dernier cri,* and he is publicising it accordingly. The near future will probably reveal how ruthlessly he will do this.

But—as stated earlier on—Trippe is not only an extremely capable man, but an extremely lucky man, too. And, just at the outbreak of World War II, he was literally waylaid by luck, for it was the war that really freed him from his strongest competitors. No Pan Am balance sheet can ever show fully what this meant for the company.

You see—before the war the British were able to put many an obstacle in Trippe's path. They could forbid him entry into their overseas possessions throughout the world. When he threw his bridge over the Pacific, the British did not allow him to enter Hong Kong at first, so that he had to be content to use a second-rate base in the Far East, the nearby Portuguese port of Macao. The routes to Australia, India and other British dominions and colonies were to him an almost unrealisable dream before the war. It was not until the structure of Empire began to show fissures that he could seep his way through. And the French ? In South America they had accomplished a great deal of pioneer work with the former Aéropostale carrier, later absorbed into Air France. They had invested millions of gold francs in that vast organisation which Trippe was able to inherit effortlessly when France was overrun by the Nazis. However,

The latest addition to P.A.A.'s long-range fleet is the 75-seater Boeing "Stratocruiser," which is shown here at London Airport, where it arrived on April 4th, 1949, after its maiden Atlantic flight.

he scored highest when he took over the enemy property of the former Deutsche Lufthansa, with all its Central and South American subsidiaries, agencies and installations. A few hundred million dollars literally fell into his lap. Which balance sheet shows this entry ?

And all this was topped off by the wartime gains which P.A.A.—whether it wanted to or not—had to make under contract to the U.S. Army and Navy. It is a well-known fact that money can be earned hand over fist in time of war. Need's must when the Devil drives. When top military brass issues an order and demands that it be executed at a given time, the cost factor plays no part at all. Thus, when it was ordered that this or that equipment, this or that unit, be transported within this or that time to South America, Africa, Europe or Australia, Pan Am's organisation promptly sprang into the breach. The bill was presented later, and it is improbable that P.A.A. lost anything by it.

The purpose of this discourse is not to raise objections to the way in which Juan T. Trippe handled his company's affairs in time of war. Nor is it aimed to calculate his wartime gains. That would be impossible as well as impetuous. However, it is necessary to refer to those points if we are to find answers to the questions set earlier on : How is it that Pan American can urge fare cuts at a time when other carriers are struggling to keep their heads above water ? How is it that Pan Am's cash box is always full, and others' always empty ? How does P.A.A. manage to continue expanding, making the others more and more dependent on it ? One is tempted to assume that it can do all this only because it must have garnered gigantic reserves and, above all, an enormous amount of goodwill during the war.

And to this comes a ruthless attitude towards competitors, in which connection an important witness recently testified.

The publication we mentioned above, *Time,* quotes the former Chairman of the U.S. Civil Aeronautics Board, James M. Landis, who says of Trippe : "Juan Trippe is thinking about the next decade... If anybody ever flies to the moon, the very next day Trippe will ask the C.A.B. to authorise a regular service."

But what does the same Landis say besides this of Trippe ? He is today Trippe's bitterest opponent over the merger negotiations between Pan American Airways and American Overseas Airlines, which are aimed towards what would more or less amount to a North Atlantic airline monopoly. The former C.A.B. Chairman is now representing a committee of more than 200 A.O.A. employees who see in the proposed merger a danger to themselves and their company. Commenting on his

James M. Landis, ex-Chairman of the U.S. Civil Aeronautics Board and now partner in the law firm of Landis, Gewirtz & Maclay, is a vigorous opponent of P.A.A.'s merger efforts.

request that the C.A.B. examine past activities of P.A.A. in operating routes in South America, in keeping books relating to U.S. Mail pay and in competing with other international carriers, Landis declared : "The information for which I have asked is most important in showing whether or not Pan American Airways has in the past been following policies which are inimical to the interest of the American people. If this is so, one basic problem is put forward. This is : should a company following such policies be allowed to assume much greater responsibilities in the field of international aviation through a merger deal based on stock transfers ?" In this way the former C.A.B. Chairman, in his present status of private individual, makes a clear stand against a tremendous expansion project of his country's biggest airline company. He is today doing this in his capacity as a lawyer, but presumably with the knowledge of certain earlier official procedures with which he must be acquainted through his former position as a high government official. Possibly this causes him some amount of personal conflict.

Whilst the big game of whether Pan American Airways is to become sole ruler of the North Atlantic or not, still remains undecided, reliable sources state that the carrier is undauntedly pursuing its expansion programme. It wishes to secure a place in the U.S. domestic traffic, and will succeed in this respect. At the present time Pan Am has strong participations, directly or through subsidiaries, in two quite important inland carriers, Western Air Lines and National Airlines. If it finally succeeds in its merger negotiations with American Overseas Airlines, then it will no longer have any obstructions in its path. In that case its only competitor on the North Atlantic, Trans World Airline, would be, so to speak, helpless, since T.W.A. has been working at a loss for a number of years already.

Try to imagine what such a P.A.A. monopoly would mean. If P.A.A. suddenly decreed that the North Atlantic fares be halved from one day to another, or—what it has already announced—decided to introduce coach services at dirt-cheap prices, then all the other companies would have to follow suit or else lay down their arms. Such carriers as B.O.A.C., K.L.M., Air France, S.A.S.—no matter of what nationality—would either have to quit the North Atlantic area entirely or else break the official rules and use state subsidies to oppose such American dumping. Don't believe, for instance, that such a Pan Am programme would not adversely affect airline customers. Traffic monopolies, and especially such of a private nature, are very seldom in the interest of the customer.

Juan Trippe, the friend of the people, does well to talk. In an article in *United Nations World* he describes how the average American taking a vacation will soon be able to travel by air for a few dollars, and even visit his relatives in Old Europe. He describes, for example, how a Brooklyn postal employee saved up for four years in order to afford a round-the-world trip by P.A.A. From Trippe's standpoint, of course, all this is quite right. The average man's pennies above all can make one really well off. And very logically, too, Pan Am's president opines that the best American policy would be to spread the money around and bring dollars into dollar-poor Europe. In one way or another these dollars would certainly flow back into America some day. But is he always so consistent ?

Apparently not, to judge from a recent incident. The shortcomings of British civil aviation are well known, and these stem not least from the lack of suitable airliners. Now the Chief Executive of B.O.A.C., Whitney Straight, has lately been endeavouring to put matters right by looking out for U.S. transport aircraft, as British models are still in the design or test stage. In addition to six Boeing "Stratocruisers" ordered a long time ago in the U.S.A., he has taken over an order for four more units originally placed by Scandinavian Airlines System.

What happens ? Republican Senator Owen Brewster, who is reputedly a close associate of Pan Am's president, Juan Trippe, raises a hullabaloo against the British move, stating that the United States was supplying Great Britain with "Stratocruiser" airliners "at America's expense," whereas U.S. air carriers, on the other hand, could not afford to finance such purchases. Thus the Senator objects to Marshall funds being used by the British to compete with U.S. civil aviation... And against whom would the British be competing ? Nobody but Pan American Airways ! And the good Senator overlooks the fact that these dollars—just like the average American holidaymaker's dollars—must in one form or another flow back into America's cash-boxes. What's good for one is good for another ? After all, the purchase of commercial transport aircraft is fully in line with the ideals of the Marshall Plan, for it basically serves the economic reconstruction of Europe.

Let's take another case. K.L.M. Royal Dutch Airlines—a carrier which, so to speak, "discovered" civil aviation—operates between Europe and South America. The company flies well, has an excellent reputation, and its aircraft are invariably sold out. Now, one gains appetite while eating, and this goes for K.L.M. too. Thus the company contemplates intensifying its schedules and announces three instead of two weekly trips between Europe and Rio de Janeiro, Montevideo and Buenos Aires. What happens ? Panair do Brasil, which operates a similar route, objects to this competition, with the result that after April 15th K.L.M. airliners had to terminate their flight at Dakar, on the west coast of Africa, because Brazil, under Panair pressure, temporarily refused landing and transit rights to the Dutch. Don't let us speak of freedom of the air, nor of coincidences either ! It so happens that 48 per cent. of Panair do Brasil's capital is—at present, at least—held by Pan Am and thus by Mr. Trippe. Is anyone going to believe that Mr. Paulo Sampaio, president of Panair, took these steps without the assent of his big partner in New York ? Here you have an elementary example of how one fights a competitor if he can't be bought up.

This brings us to the end of what we wanted to prove. Juan T. Trippe, the strongest man in international civil aviation, is successful, lucky, and ruthless. He is striving for a monopoly and consequently a dictatorship. The Americans are objecting to this dictatorship, and the Europeans, too, should not overlook it. If they choose to ignore it, they might make bitter experiences. Right now, they still have time to take stock of their situation and get together. They will find no shortage of allies on the other side of the Atlantic.

And Juan T. Trippe himself. A man who comes from an old Maryland family, proudly sports a Yale tie, has excellent family connections, belongs among the "upper ten thousand" and is, in the round sense of the words, a millionaire and big-salary-drawer—it is difficult to imagine such a man in the rôle of a social public benefactor. His public relations service has overshot the goal. Trippe is a big businessman—the biggest airline operator in the world. It is quite thinkable that he should make a gesture in favour of the well-being of his employees and collaborators. That he should seek his customers where he finds them, is his right. That he makes every effort to win over these customers to his company, is his duty. But the way in which he has hitherto driven his competitors to the wall does not—not up to the present, at least—altogether elicit cheers for him.

At a time when the expansionist efforts of Pan American World Airways are becoming more noticeable than ever, we venture to predict that they may be stemmed by the U.S. Government itself. For precisely this democratic Government has every interest in destroying the odium of "dollar imperialism." In this respect, all quiet on the Western front...

Interlude

In Buenos Aires there is a bus service for transporting air travellers to the intercontinental airport at Moron. In a few months' time this airport is to be replaced by a new and magnificent facility at Ezeiza.

European competition for P.A.A. in South America. Offices of Scandinavian Airlines System in Buenos Aires and Rio de Janeiro.

Thus off we go to Moron. These buses are the *non plus ultra* of the U.S. automobile industry—technical marvels, fast and comfortable. The Argentine chauffeurs are true artists.

Moron airport ? Passenger handling is excellent, despite the complicated passport and customs formalities. The visitor feels how the officials have been instructed to be polite and businesslike. No reason for complaint at all... except, of course, if you are unlucky enough to run into an Argentine sports demonstration. Our departure was scheduled for one o'clock in the morning, but just beforehand was the take-off of an Argentine aircraft carrying some sort of sports team. The airport disappeared from sight. All one could see was a seething mass of men, women, children, flags, and brass bands—a convincing proof of national feeling, though not exactly what the doctor would prescribe for international airline traffic. The flight took place one hour behind schedule.

Landing at Rio de Janeiro... The international airport, Galeao, is situated on Governador Island and is linked to the centre of the city by two bridges still under construction. If ever the military people evacuate the airport—which they are apparently going to do, one day—and the facilities are properly arranged, then Galeao will rank among the finest airports in the world. In bright sunlight it now looks like the approach grounds to a major penitentiary.

We are soon riding through the streets of Rio de Janeiro. Crowds of people. Suddenly we find ourselves confronted by Copacabana Beach, with its tall buildings, low hills and colourful hinterland. Rio... surely one of the world's most beautiful cities !

It is also the cross-roads of air routes coming from north, south, east and west. In a wide open country like Brazil, which can unlikely ever be completely covered by railroads and highways, many vistas are placed before civil aviation. Panair do Brasil has grasped this ; the other national carriers do not seem yet to have fully understood the opportunities ahead. The visitor from Europe is astonished to see that the heritages left behind by the French Aéropostale and the German Lufthansa have not been put to better use. Southern apathy... Why bother ? Everything will ultimately turn out all right.

Nonetheless, one feels that people are working. The North Americans have done plenty of the spadework...

Take-off, Europe-bound !

Landing at Dakar-Yoff airport, on the West African coast, in French Equatorial Africa. Again and again I must register surprise that the French Colonial Government has still not yet understood how foreign travellers could be impressed by the term "Union Française" if the facilities at Dakar were not—shall we say—so modest. A little too much native African colour...

Landing at Lisbon. One feels Europe !

I could not help but think back on a last meeting in the lobby of the hotel in Buenos Aires. It was late, about two hours before the night-time take-off.

A lady approached us : "Are you flying back to Switzerland ? We are Swiss. We have

Circling over Rio.

lived in Buenos Aires for the past eight months. Aren't you afraid of war... ?"

What should one answer ?—"Europe's still worth defending..."

Which brings us right back to politics.

Europe's still worth defending

During the first days of last April, the columns of the daily press were filled with reports about a happening which came as a surprise neither to the participants nor to the non-participants. The only surprise came to the Danish Government, which received from the Soviet Union—ostensibly in the nature of an April Fool's prank—a Note in the middle of the night, protesting against Denmark's joining the Atlantic Pact.

On April 4th, the Foreign Ministers of ten European countries (Great Britain, France, Italy, Holland, Belgium, Luxembourg, Norway, Denmark, Iceland and Portugal) and of two American countries (United States and Canada) appended their signature to this agreement of mutual assistance. Assistance against any attacker, whereby it is hardly to be expected that Iceland will attack Portugal or Italy march on Denmark. With some justification, Russia thought people were pointing at her.

She answered with Notes. What puzzles me is why her answer did not consist in a request also to join the Pact. A more unambiguous declaration of peace could not be conceived. Besides, such a gesture would not have been without humorous consequences.

Meanwhile, what does this Atlantic Pact signify ? The Russians see in it a threat and a preparation for war ; the Americans and Western Europeans regard it as an obstacle to war ; and the Germans, living in the heart of Europe, are waiting to see whether they belong to Eastern or to Western Europe.

But if it ever came to a conflict between East and West, or West and East, then Western Europe, including the British Isles, would become a natural glacis of the U.S.A. For that event, the Western European countries are pledging themselves to mutual assistance, and—what weighs heavier for them—they have received, for the first time in time of peace, a promise of help from the U.S.A., the decisive victor of the last war. Finally, the Europeans may possibly receive U.S. armament—a point on which the wise men of Washington have not yet quite agreed, owing to the ramifications involved. For the present, Great Britain is arming the Western European countries with fighter aircraft by handing around the licence to manufacture de Havilland "Vampire" jet fighters. To this comes the possibility of the U.S. Air Force eventually handing over a few bombers to European countries for training purposes.

Thus, while the Americans are establishing this glacis, they are endeavouring to come to a clear understanding on the lines their own defence policy ought to follow. Should they neglect the Army and Navy in favour of a strategic Air Force composed mainly of bombers ? This policy has its followers. Should they not, above all, hasten their research activities on remote-controlled and robot missiles ? Or should they abide by the conventional principles—keeping well in mind the construction of aircraft carriers, Naval aircraft, and equipment of the Army—and build up a traditional armament anew, in order to be ready for eventual landing operations ?

Amidst this to and fro, the U.S. Secretary of Defence, James V. Forrestal, was replaced by Colonel Louis A. Johnson, who is attributed an exceptionally energetic character. Possibly in line with the last developments in international politics, the Russian Minister of the Armed Forces, Marshal Nikolai Bulganin, was almost simultaneously replaced by Marshal Alexander M. Vassilievsky, who is reputedly the Soviet Union's most brilliant strategist. That was the external change of appointments.

In the meantime, the U.S. Press is taking a lot of trouble to make even the most backward of backwoodsmen airminded, by bringing him lurid descriptions, in word and picture, of an aircraft which, they say, is a wonder weapon, an instrument capable of deciding a next war—the six-engined Consolidated Vultee B-36 long-range bomber. It speaks for the sound commonsense of the new Defence Secretary, that he has thrown a blanket over this over-fiery enthusiasm. The Russians ? They are not uttering a single word which might help to disentangle the enigma of whether or not they have the atom bomb, how many aircraft they are building and could put into front-line operation. And in this silence there lies, too, a certain strength—in any case, diplomatic strength...

Why all the fuss ? I must always recall the agitated lady in Buenos Aires. All this somehow gives the impression of having been "staged." Let us not forget that the Russians—already in Czarist days—also possessed a very fine theatre.

For the rest... All quiet on the Eastern Front, too. *E.E.H.*

Rio's international airport, Galeao, is situated on Governador Island ; two bridges connect it with the city.

The British Aircraft Industry

BY C. G. GREY, LONDON.

C. G. Grey, Founder and Editor of "The Aeroplane," 1911-1939; Partner in "All the World's Aircraft," and Editor and Compiler from 1915 to 1941.

Interavia has paid me the compliment of asking me to write a series of short articles giving the histories of the more important firms which together form the British aircraft industry. After living in, by and for aviation for 40 years (1908 until today) I can claim to have known all our aircraft firms before they were born. But the difficulty of my task lies, not in finding the material about which to write, but in deciding on the order of precedence in which to write it. To arrange them in alphabetical order would be to put some of the biggest and most important firms at the end of the list. To put them in order of seniority would be equally liable to objection. So I propose to deal with them in order of size, and as this places two of the oldest firms in the front I hope that everybody will be pleased.

THE HAWKER-SIDDELEY GROUP LTD.

The Hawker-Siddeley Group Ltd. is the biggest purely aeronautical combine in the British Commonwealth and Empire. It includes, in alphabetical order, (a) Sir W. G. Armstrong-Whitworth Aircraft Ltd., (b) Armstrong-Siddeley Motors Ltd., (c) Gloster Aircraft Ltd., (d) Hawker Aircraft Ltd., (e) A. V. Roe & Co., Ltd., and A. W. Hawksley Ltd., (f) A. V. Roe (Canada) Ltd., (g) High Duty Alloys Ltd., and (h) Air Service Training Ltd. The Chairman of Directors is T.O.M. Sopwith, a pioneer of 1910, who still flies, and was the originator of the historic Sopwith Aviation Co., Ltd., of 1911, from which Hawker Aircraft Ltd. are descended. The Managing Director is Sir Frank Spriggs, K.B.E., all of whose aviation career has been spent with the Hawker Co. The other Directors are H. Burroughes, of the Gloster Co., Sir Roy Dobson, C.B.E., of A. V. Roe & Co., Ltd., commonly known as "Avros," and H. A. Meredith, O.B.E., another Hawker man. Between them they cover a large section of the British aircraft industry.

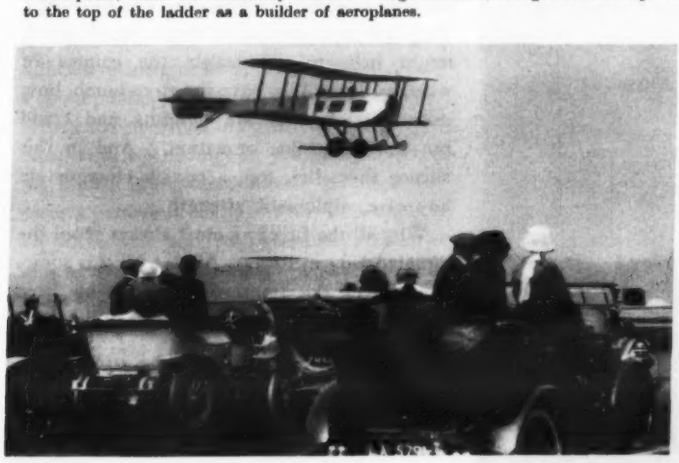
In 1910 at Brooklands Aerodrome, T.O.M. Sopwith, aged 22, took his pilot's certificate (No. 31) on a Howard-Wright monoplane.

The Sopwith-Hawker Story

I propose to start with the Sopwith-Hawker business because that is the foundation on which the whole combine was built. When I first met T.O.M. Sopwith, at our first aerodrome called Brooklands, in 1910, he was a slim young man of 22 years of age. He had lots of money and cars and motorboats, and seven sisters older than himself, which is why he was christened Thomas Octavius Murdoch Sopwith (the Sopwiths, like all families whose names end in "with," belonged to Cumberland or Westmoreland). Today he is still reasonably slim and has had a lot more money, and still does valuable work.

Unlike most opulent young men, T.O.M. (generally known in those days as "Tommy"), instead of wasting his wealth on riotous living, learned engineering seriously—although he himself is one of the wittiest and most amusing of men. And he was a magnificent driver of

This biplane, which the Admiralty ordered in large numbers, brought T.O.M. Sopwith to the top of the ladder as a builder of aeroplanes.



Towards the end of World War I the Sopwith "Camel" single-seat fighter made the young firm's name known the world over.

The Hawker "Fury"—the first version of this name, designed in the thirties by Sydney Camm, Hawker's Chief Designer.

The Hawker "Demon" two-seat light bomber was still part of the R.A.F. equipment in 1939.

The first squadron of Hawker "Hurricane" single-seat fighters.

cars and boats. So naturally when flying began in England, in 1909, he took to it.

He bought a Howard-Wright monoplane and flew it. His pilot's certificate, No. 31, is dated November 22nd, 1910, but he was flying long before that. And with him, into aviation he brought his chief engineer who looked after his cars and boats—Fred Sigrist.

In 1911 T.O.M. and his sister May and Fred Sigrist went to the U.S.A. taking with them a Blériot two-seat monoplane. On it Tommy won a number of prizes and made money. When they came back they brought a Wright biplane with them, because they saw that it had useful constructional features, although its control system was suicidal, and aerodynamically it was dangerous.

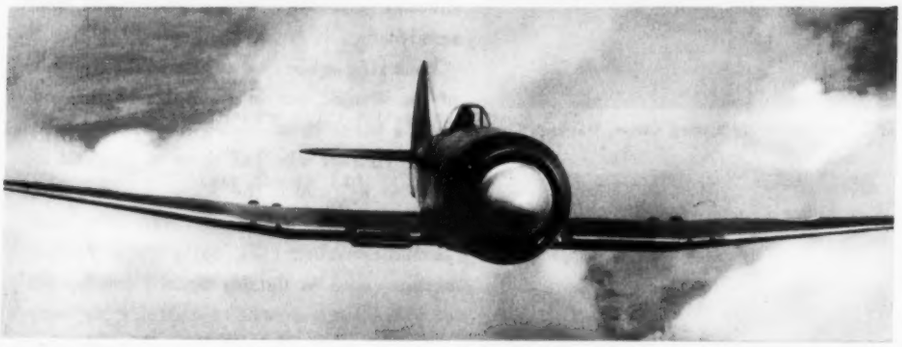
Back at Brooklands they altered the controls of the Wright, put in a sensible engine and fitted a tail to it. A young Australian named Harry Hawker who had come to England to learn to fly, joined the Sopwith party, and, after taking his pilot's certificate (No. 297, dated September 17th, 1912) on a Farman biplane, used to fly this bastard contraption very well—those who could not fly very well, and many who did fly well, were killed when they tried to fly a Wright, and all Wright designs ceased to exist after about 1915.

So the Sopwith party designed a tractor biplane of their own, combining the good qualities of every machine they knew. They rented a roller-skating rink at Kingston-on-Thames as a factory, and the machine was built to drawings in chalk—the plane on the floor, and the front and side elevation on the wall. (The skating-rink is still there right alongside the great modern Hawker factory in the same street.)

That first Sopwith biplane flew beautifully. Tommy had, and still has, a wonderful eye for an aeroplane ; Fred was a real craftsman,

1942 : "Hurricane 2 C" armed with four 20-mm. cannon.

The "Typhoon" single-seat fighter, powered with a 16-cylinder Napier "Sabre" engine.



The "Tempest 2," powered with a Bristol "Centaurus" twin-row radial.

A Hawker "Sea Fury" fighter about to land on the deck of H.M.S. "Illustrious."

as well as an engineer ; and Harry, as a pilot, was a genius at judging the controls and stability of an aeroplane.

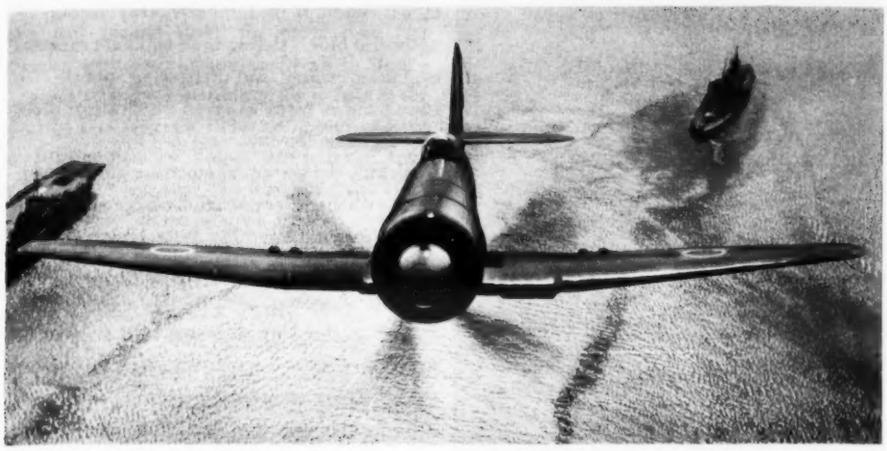
The Naval pilots liked the machine and the Admiralty ordered a dozen. Such a large order surprised the Sopwith party so much that Tommy decided to go into the aircraft trade seriously. Also, he promised Fred Sigrist a handsome bonus on every aeroplane they built, and Harry Hawker likewise was paid a sum for every one he tested.

In 1913 the Sopwith Aviation Co., Ltd., was registered. One of its first and most notable products was the "Tabloid" biplane, which, with a 50-H.P. Gnome engine, had a top speed of 84 m.p.h. and landed at about 30 m.p.h.—a performance hardly believable in those days. One of the type on floats won the Schneider Trophy at Monaco in 1914.

Then came the war, in August of 1914. First the Navy, and then, in 1916, the Army (the Royal Flying Corps) ordered Sopwith aircraft without limit. The Royal Naval Air Service ordered numbers of "Schneider" types as single-seat scouts to be carried on ships. The Royal Flying Corps had first the "1 ½ Strutter," so called because it appeared to have 1 ½ interplane struts on each side. It was the first British aeroplane to carry a gunner behind the pilot. Then came the "Pup," an enlarged "Tabloid" ; and then the "Camel," so called because the pilot sat on a sort of hump, to give him a good view over the engine. Last there was the "Snipe" with a 240-H.P. Bentley engine. There were various other types, including a torpedo-dropper, called the "Cuckoo," which was catapulted off a rail on board ship.

Many thousands of Sopwith aircraft were built, by subcontractors as well as the Sopwith Co.—and T.O.M. never went back on his original verbal agreement with Fred Sigrist, who came out of the war a very rich man, after being works manager for most of the war. Harry Hawker also grew rich on his test fees. And, at the end of the war, when all aircraft orders ceased, the shareholders, who were all members or relations of the Sopwith family, dissolved the business.

To keep the works employed, a new business was formed, and was called the H.G. Hawker Engineering Co., Ltd.—to prevent confusion with the Sopwith Co. It lost money making



The "Sea Fury" (1947) is the last propeller-driven Hawker fighter type.

motor-bicycles, and in 1920 the shareholders resolved to build aeroplanes. The shareholders were T.O.M. Sopwith, a friend of his named Eyre, Fred Sigrist, and Harry Hawker. But before they began on aircraft Hawker died in the air, of a seizure, in a racing machine of another make. So the man who gave his name to so many famous aeroplanes never saw one of them.

The first aeroplane designer of Hawkers was Wilfred Carter, who later designed all the Gloster turbine-jet machines. He was succeeded in 1927 by Sydney Camm, who produced the historic Hawker "Harts" (and their variants as two-seat fighters and light bombers) and the "Fury" fighter. These were succeeded in 1938 by the famous "Hurricane," the first eight-gun fighter.

In 1938, when international politics began to look dangerous, T.O.M. Sopwith and his co-directors—Fred Sigrist, Frank Spriggs (later Sir Frank), H. K. Jones, and P.W.S. Bulman —put an order into the works for several hundreds of "Hurricanes" to be built in series, without waiting for an order from the Air Ministry. The result was that, in the Battle of Britain in the Autumn of 1940, there were four "Hurricanes" for one of any other make, and "Hurricanes" shot down more enemy aircraft than did all other makes (German and British) together.

Also, at no time was there any scarcity of "Hurricanes." In spite of the story that the R.A.F. was at one time down to its last half-dozen machines, there were in fact always hundreds of "Hurricanes" in store. The tale about Mr. Churchill visiting Air Vice-Marshal Keith Park and being told, when he asked about reserves, that all Park's reserves were in the air, is explained by the fact that the reserve squadrons had started out on patrol, while those which had been out were on their way home. There were plenty of "Hurricanes" at the depots and in the sheds.

After the Battle of Britain, newer type "Hurricanes" came out with Hispano-Suiza cannon-guns of 20-mm. bore. Some were fitted with 45-mm. tank-busters, but they were not very effective as the aircraft had to fly *ventre-à-terre* to get low enough to put a broadside into a tank. However, what beat the tanks and troops on railways and roads, were the "Typhoon" and the "Tempest," which fired salvos of rockets (carried under the wings).

The N 7/46 carrier-borne fighter, with folding wings to facilitate storage in aircraft carriers, was developed from the P. 1040.

Transition to jet propulsion : the prototype of the Hawker P. 1040 single-seat fighter, with a single turbo-jet engine inside the fuselage and jet outlets on either side.

Since fighting ended, Hawkers have been busy making improved types of "Tempest" with more powerful engines. And the firm's (Sydney Camm's) latest product is a single-seat fighter with a single turbo-jet engine. It has been adopted by the Royal Navy as a carrier-borne fighter. Its performance is very high—in speed, climb, and height.

Hawker Aircraft Ltd. and Sydney Camm are well maintaining the reputation which they won in the Battle of Britain. And T.O.M. Sopwith and Sir Frank Spriggs are building still higher the reputation of the Hawker-Siddeley Group.

UPS AND DOWNS
in advertising.

For Sale... The Blue Sky

BY SCHOLER BANGS, LOS ANGELES

Each morning John Holzer, a Los Angeles automobile dealer, would rush to the window upon awaking and find life good if he could see "Honest John" written in huge white letters upon his own great big beautiful sky.

That's the seductive thing about buying advertising space on the world's biggest billboard.

The first time you can shrug if off—after paying the bill, which may be quite a handsome one, presented by the skywriting salesman.

But after two or three times you'll feel that the sky above is your own private property. You'll almost howl with rage at the affront of Nature when a shroud of cloud sweeps across the particular patch you had hoped to desecrate with whatever message might lure customers to your cash register.

Which is exactly the way a growing legion of professional skywriters will want you to feel this summer, after spring clouds have wiped the billboard clean and blue.

Skywriting has suddenly and violently come of age, and its "big business" potentialities are such as to warm the hearts of patent medicine makers who may admonish you : "Buy Dr. Quack's Kwik-Kure Salve For Stiff Necks—Enjoy Those Sky Ads !"

It is almost a certainty that if you live in a densely populated area you either will be (1) joining those who feel they own the heavenly reaches, or, (2) gawking, along with millions of others, at the smoke-streaming antics of gnat-size silvery specks dashing here and there three miles above your straining eyes.

The romantic adolescence of skywriting—the era of a dazzlingly handsome pilot braving the elements to try to complete a single perishable word before the winds erased it—has vanished.

Now, all "business," as many as six chemical-laden war-surplus North American "Texan" trainers will poise in formation at 15,000 feet and at a signal whip out a complete ad in a mere few minutes. Without delay, they'll repeat it in another nearby section of unspoiled blue. Before their tanks are exhausted, their weary and perspiring pilots may have hung as many as seven duplicate or different signs in the sky.

Already the sky-ad salesmen are busy ringing the doorbells of corporations large and small, joyously humming "My Blue Heaven"—and selling it in big and small chunks.

Their biggest, and already time-tested, market is the United States, where business firms have made a fetish of spectacular advertising. There are strong indications that South America is ripe for the plucking of lush skywriting contracts. And some American skywriters feel that with four and six-plane teams they can spread their "art" throughout Europe and the Far East.

The Skywriting Corporation of America, which fathered the business twenty-two years ago and maintains skyscraper offices in New York City, will contract 12,000 or more sky ads above United States cities this year, and in addition send its planes touring through Canada, and Central and South America.

So lush are the prospects that two employees of North American Aviation, Inc., have equipped two "Texans" with smoke gear and fully expect to experience a sharp increase in their 1949 income tax.

One group of Los Angeles skywriters plans to set up a "School of Skywriting," and charge $1,500 for a six-week course which will include delivery of a "secret" formula for smoke chemicals.

A Southern California university professor has come up with the idea of mixing fluorescent zinc sulfide powder—the stuff which makes the greenish glow on your luminous watch dial—in smoke-writing oil to create luminous night sky ads. The fluorescent writing in the night sky would be activated by bombardment with ultra-violet beams directed upon it from the ground.

World War II fighter pilots are elated over the prospect of being able to chuck their humdrum jobs as bank clerks and insurance salesmen and hire on as smoke-writing pilots at salaries ranging as high as $10,000 a year, which is what Skywriting Corporation pays its top pilots for spending their days in "commercialised dogfights."

Why this sudden excitement over the business of plastering upon the sky brief phrases in immaculately white block letters each a half-mile high and a quarter-mile wide ? Why,

after the relatively sedate Skywriting Corporation had rocked along for more than two decades with the sky practically all to itself ?

Much of the responsibility for it falls at the door of Los Angeles' "Honest John" and the skywriting firm of Vogue Advertising, Inc., which last year kept the Los Angeles skies cluttered from dawn to dusk with an amazing assortment of ads.

When his skywriters were not telling the populace "HJ WANTS YOUR CAR," they were scurrying about writing ads for radio stations, dog foods, suntan lotions, midget auto races, professional football games, new movies, restaurants, dance bands, charity fund-raising drives, and political campaigns.

The results were often startling—and the word simply began to get around, and still is spreading.

Vogue's spot checks showed that a sign above a densely-populated residential section, or a public beach, will be seen and read by one out of every five persons.

"Honest John" could count upon a single sign, hung at 18,000 feet, being legibly visible to all within an area of 1,430 square miles of terrain beneath, with the aid of a smooth wind to move the sign along before it disappeared.

Five minutes after he had added his used car lot's telephone number—FItzroy 1221—to a sign, the FItzroy switchboard of the 'phone company was as bright as a three-alarm fire. After telephone operators had unsnarled the mess, the 'phone company politely asked Holzer PLEASE not to put his number in the sky again. It was jamming the exchange.

Up to the time that "Honest John" took over California's dazzling sky, and by squatter rights figuratively ousted the sunshine-advertising Los Angeles Chamber of Commerce and Californians, Incorporated, there was considerable abracadabra about skywriting.

Its handful of exponents cloaked it in mystery, and charged accordingly.

Today, with some reservations, it is a straightforward "big business" designed to sell its commodity—advertising—strictly upon a showing of what it can be expected to produce for the buyer's dollar.

CROSSING THE VERTICAL AND HORIZONTAL LINES OF AN "A" (top), in skywriting, requires every trick of a fighter pilot's trade.

AIRBORNE CALLIGRAPHIC FOURSOME (centre). To make this shot, our photographer, Robert C. Cox, had to sit backward astraddle the chemical tank of one of the aircraft. At working altitude, the skywriting pilots can obtain no visual check on their results.

DOG FOOD AD (below) high above Hollywood.

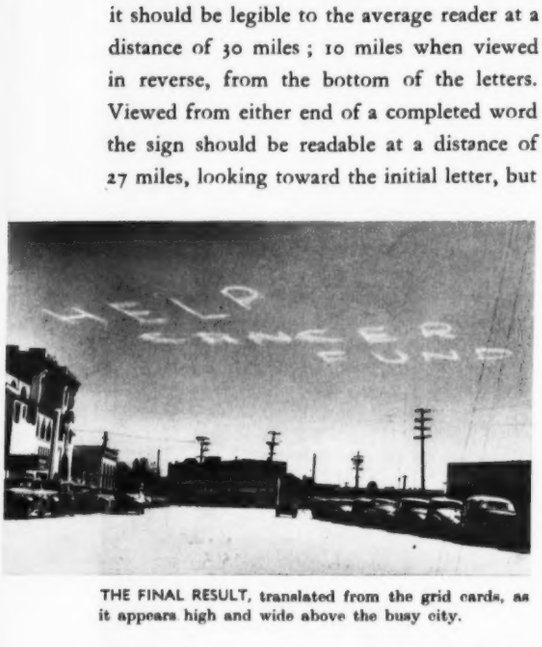
Vogue Advertising, for example, quoted a flat rate of $11 per letter within a 90-mile radius from its operating base at Grand Central Airport in Glendale, adjoining Los Angeles.

A 24-unit sign, costing $264, could be laid by a four-plane team in 10 minutes, and would be readable for another 20 minutes, on the average. In choppy wind a completed sign might last no longer than five minutes. Under ideal conditions it might remain legible for as long as an hour and a half.

At what distance can it be read ?

Vogue had the answer for that one, too.

Viewing a sign from the top of the letters, it should be legible to the average reader at a distance of 30 miles ; 10 miles when viewed in reverse, from the bottom of the letters. Viewed from either end of a completed word the sign should be readable at a distance of 27 miles, looking toward the initial letter, but only 18 miles as viewed toward the ending letter. The differences in distance legibility can be supported quickly by holding this copy of *Interavia* above your head and viewing the cover title from all positions at increasing flat (distance) angles.



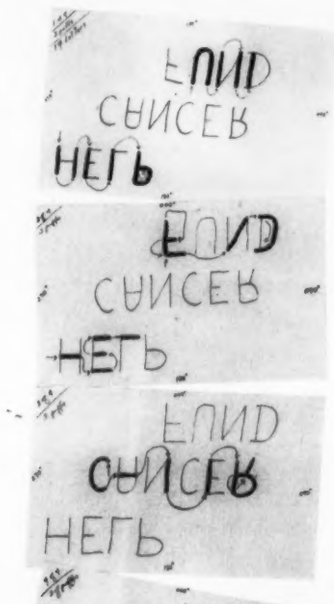
THE FINAL RESULT, translated from the grid cards, as it appears high and wide above the busy city.

Such specifications are for an "ideal" seeing day.

For best skywriting effect, the sky must be an exacting, brilliant blue. A scattering of broken clouds casting long shadows, a solid overcast, or even a filmy veil of heat haze will spoil the effective contrast of snowy white lines upon an azure background.

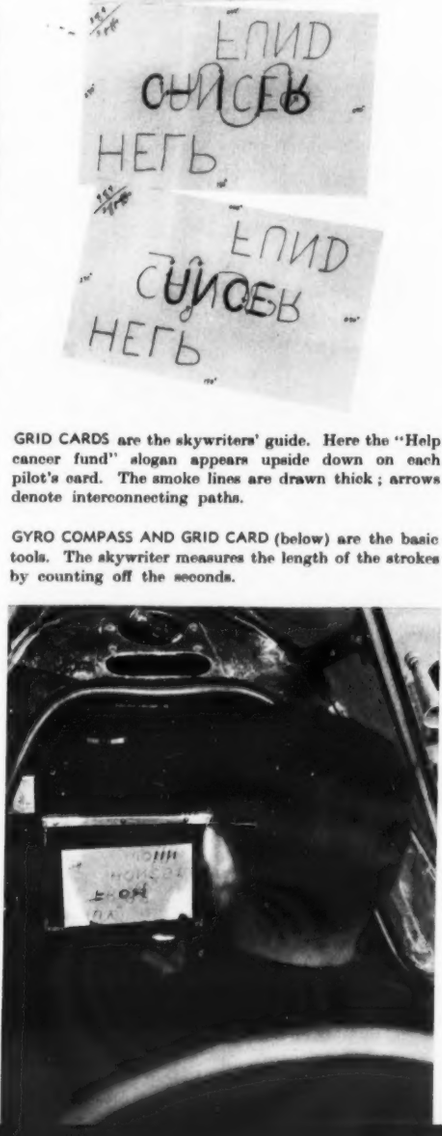
Coloured smokes ? Some skywriters have tried them, for overcast days. But the pigments are costly, and people aren't inclined to look up involuntarily into a grey sky as they will when there is blue magic in the air above.

HOW DO YOU DRAW A DOG'S HEAD ? These four skywriters are huddling over their grid cards before doing it their way !



GRID CARDS are the skywriters' guide. Here the "Help cancer fund" slogan appears upside down on each pilot's card. The smoke lines are drawn thick ; arrows denote interconnecting paths.

GYRO COMPASS AND GRID CARD (below) are the basic tools. The skywriter measures the length of the strokes by counting off the seconds.



It is a gamble, to some extent, with the sky ad salesman matching his promises against the unknown factor of what the weather will be like after you have signed on the dotted line.

The average skywriting concern takes weather uncertainties into account, however, and will do a repeat performance if the customer has a legitimate complaint against the quality of the ad he has bought.

Should a skywriting salesman come calling on you some day don't be surprised if, in the midst of his sales talk, he bounces out of his chair for a quick look out of the window.

He's just taking a quick "blueness" reading, and may ask if he can use your 'phone for a moment :

"George, this is Mac. Howzit look ? Haze burning off above the field ? Swell ! Smog's breaking down here. Should be blue enough in about an hour. Pass the word to the rest of the boys as they call in, and we'll get busy."

"Mac" may scoop up his sales folder, or even forget it on your desk, and dash out with assurance that he'll be back tomorrow to sign you up for that ad.

Within an hour he'll be in the cockpit of one of four almost invisible specks moving in irregular paths above you and streaming white ribbons which suddenly join each other and become first letters and then words.

It used to be that a lone skywriter would work the blue void, painstakingly spelling it out, letter by letter. But the chances were that, by the time he finished the first long word, the first letters of it would be vanishing into nothingness.

Not so with modern skywriting.

When the sky is ripe for a show, a four-plane team of pilots will assemble at the "office" and receive small duplicate cards bearing the ad, or ads, they are to write.

Each "grid card" shows, with heavy lining, the segments of letters the individual pilot will start writing upon a smoke puff signal from the flight's leader after planes have been positioned at an agreed altitude and location.

A quick, practised briefing on the ground, a check of "smoke" tanks, each holding sixty gallons of oil and chemicals capable of producing thirty complete letters, and they are off the ground and climbing steeply.

What altitude ?

At twelve thousand feet the flight leader cuts loose a coded series of puffs. Air's too bumpy. It would foul up the writing.

Fifteen ? Again a negative signal. No wind.

So it's on with the oxygen masks and up

to eighteen thousand where the air is certain to be smooth and moving at the twenty-five to thirty miles per hour pilots have found to be best to drift a sky ad over the maximum area of ground.

At the final altitude the lead plane circles, its pilot hunting for the most distant visible landmark. Los Angeles skywriters find Catalina Island is a good one. But Mt. Whitney, highest peak in the United States, two hundred miles away, is better.

Like pilgrims turning towards Mecca, the smokers line up and face the marker, and at a signal set their gyro compass cards to a uniform, pre-agreed reading.

From there on all of their manoeuvres will be done with relation to compass headings called for on the grid cards.

All set !

Go !

A smoke puff from the lead plane, and the fun begins, with four pilots rapidly working up a pouring sweat under the canopies of their darting converted trainers.

One thousand and one ; one thousand and two, one thousand and—turn. One thousand and—chop and turn. One thousand and—on smoke ; one thousand and four, one thousand and five—cut smoke and dive.

Steadily, quickly, timed by lips silently pacing the length of the smoke trail strokes, each blossoming into a boiling white ribbon 200 feet wide, a pilot flies the pattern of his grid card.

A plane stroking the leg of an "A" converges upon another laying down the crossbar of the same letter. They miss each other, one above and one under, by a scant fifty feet !

"That's miles of room if you're used to doing tight formations," says skywriter George H. Smith, an ex-Navy fighter pilot.

Flying on the common level of what they have written, the quartet cannot read the results of their handiwork. But they know from experience that unless someone skipped a "thousand and" it will be perfect.

A swift dash to another section of waiting blue sky, and the lead plane spurts another puff signal.

Time to turn to Grid No. 2 and start the second sign.

DRAWING PARALLEL LINES (top) is good practice but seldom called for in skywriting.

GOING TO WORK AT 15,000 FEET (centre): one pilot draws the slanting line of a letter "N," another starts the next letter.

IN THE AIR... ON THE AIR (below): advertising a radio programme. The "Y" of DLY (Daily) has not yet been completed.

THE EXHAUST STACK of the skywriting plane is surrounded by a shroud in which the smoke-producing oil mixture vaporises.

Since the sky ads call for clear weather flying, the pilots make little use of plane-to-ground radio, and carry no plane-to-plane radios. It is precision flying throughout, with all planes keying their movements to the smoke signals of the lead plane.

Smith graphically explained to me why radio is seldom used :

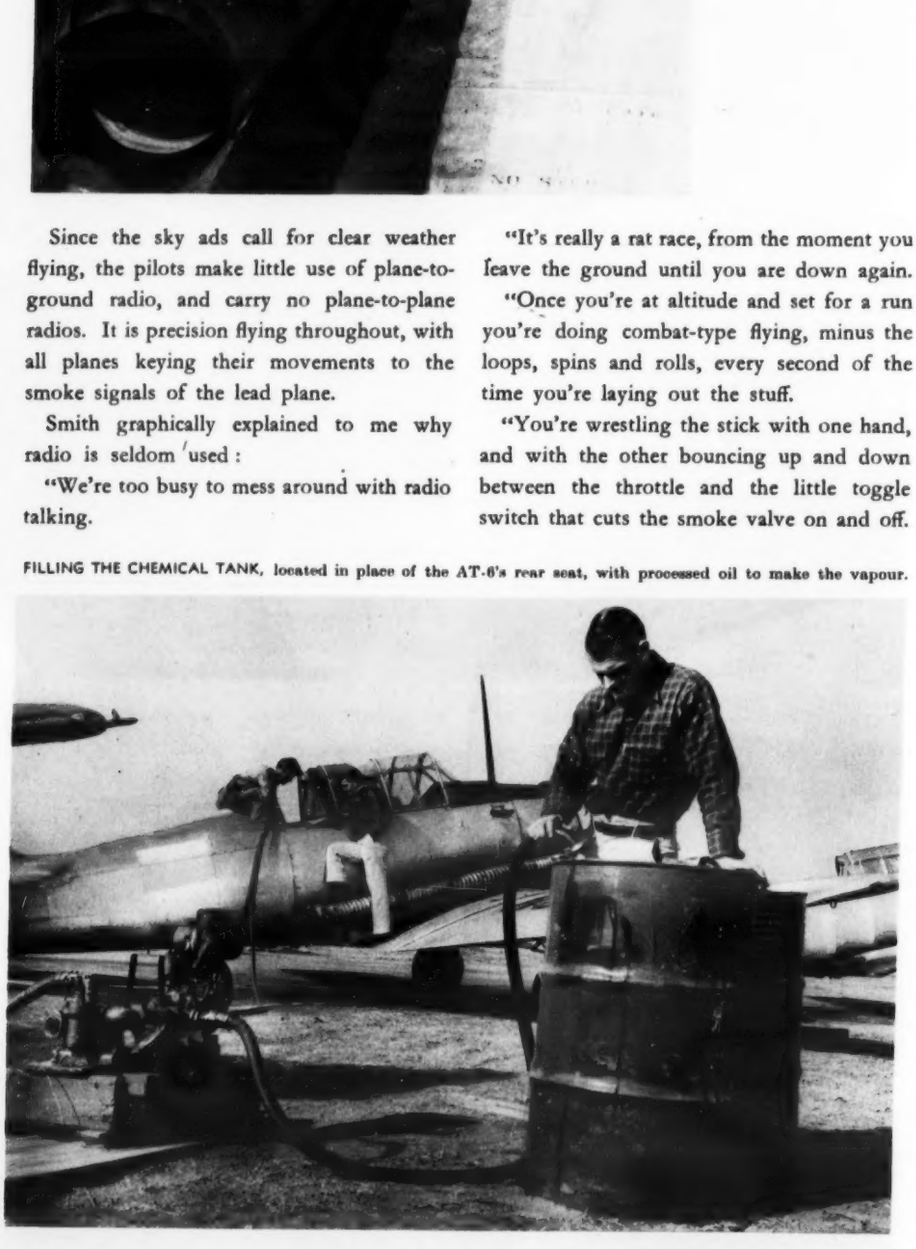
"We're too busy to mess around with radio talking.

"It's really a rat race, from the moment you leave the ground until you are down again.

"Once you're at altitude and set for a run you're doing combat-type flying, minus the loops, spins and rolls, every second of the time you're laying out the stuff.

"You're wrestling the stick with one hand, and with the other bouncing up and down between the throttle and the little toggle switch that cuts the smoke valve on and off.

FILLING THE CHEMICAL TANK, located in place of the AT-6's rear seat, with processed oil to make the vapour.



"You count off the thousand-and's until you think you're going batty, all the time watching for foreign traffic while co-ordinating your turns with the grid card and your gyro compass.

"All the time you're doing this you are slamming about in tight turns which give you a good '5-*g*,' just on the edge of a black-out, and twisting your head around to spot the other planes—particularly your leader.

"You're watching him and the others for the thing you hope you'll not see : a series of two short smoke puffs from one plane or another.

"That's our 'join up' signal, and means something has gone wrong.

"Or, it can mean a 'Mayday,' the aviation 'S-O-S,' from someone who is in real trouble and hasn't a plane-to-plane radio to tell what's up.

"Let two puffs show and everyone drops what he's doing and goes screaming in on the plane which has signalled.

"The chances are that he merely is signalling a join-up so he can indicate he's mis-identified the leader's grid card signal. Then we have to start all over again—and do it right the second time.

"But once in a while those two short puffs really can give you a thrill.

"Like the day we were working above Long Beach, thirty miles south of Grand Central.

"One of the boys broke out of formation in the midst of writing and sent out the two puffs.

"I was leading at the time, and dove after him to see what was on his mind.

"His plane looked all right as I closed in. Prop was turning and the plane was flying smoothly in a shallow descent. But one moment we were closing and the next he was gone. I'd passed him as if he were standing still.

"I thought it was funny, and swung around to make another approach, this time with throttle back and wheels and flaps down. Again I passed him.

"Only then did I realize that he had a dead engine and was coasting. The pilot was leaning forward under the canopy, up close to the instrument board, and I couldn't get any signals from him.

"Nor could I figure why he wasn't diving down to go into Long Beach Airport, directly below us. Instead, he kept gliding on a straight course toward Grand Central, thirty miles away.

"Finally, over downtown Los Angeles, we were down to five thousand. By then I was pretty sure he was trying to make Grand Central, so I radioed the tower that an emergency landing was headed their way and would they please clear the traffic.

"Well, he came in for as perfect a landing as I've ever seen, and finished his roll by turning off the runway and braking to a stop directly in front of our overhaul hangar.

"He hadn't wanted to land at Long Beach because it would have meant a long drive for our mechanic just to repair a broken fuel primer line that had been spraying gasoline into the cockpit. He had killed his engine to avoid the risk of fire, and figured, rightly, that his two puffs of smoke would bring me alongside with my radio to run interference for him during the glide back home while he leaned forward and held a finger over the leak."

Another team-mate of Smith had an equally rough experience :

T. Harold Benson headed for the bottom of the Los Angeles River bed, adjoining Grand Central, when his engine quit just after he was off the ground.

He spotted a cable stretching from bank-to-bank and rather than take a chance on stalling over it he ducked under and climbed out without a scratch after boulders snagged his wings and totally wrecked the ship.

He was quite the cool, calm 'hero' of the moment, but a spectator, a native, seemed worried :

"Say, bub, you just don't seem to care, do you ?"

Benson nonchalantly explained how he'd planned it that way, and then turned two shades whiter under his sun tan when the native responded :

"Reckon you're a pretty good pilot. Must be. I know I sure wouldn't want to try to snake any plane under a power line packing fifty thousand volts !"

Jack Moore, of Skywriting Corporation, tells me that one of their pilots, Tom Murphy, recently ran into ready-made trouble on a writing assignment in Florida, when a large eagle "tried to get into the greenhouse, and damned near did." Thwarted by the plexiglas canopy, the eagle made a second pass at the "Texan," leaving claw scratches which still show in the fuselage skin behind the canopy.

On the whole, the skywriting profession has proved to be remarkably free of hazardous incidents. One reason is that theirs is a fair-weather occupation involving little or no blind flying. Also, the working level of the smoke planes is such that in event of an engine failure the pilots usually can stretch their glide to an airport. By the very nature of their work, and the fact that they are under public scrutiny at all times, smoke pilots tend to "play it safe"; an inclination sharpened within Skywriting Corporation by a $1,000,000 liability insurance policy placed on each of the company's 45 planes.

Greatest concern of skywriters seems to be, at the moment, that they may get too much business ; that they may cover the summer skies so profusely with their drifting billboards that they will wear out their welcome.

The British, I am told, maintain an extremely cool attitude toward such aerial advertising, and in the London area especially are so jealous of their relatively few clear days that they resent any intrusion of ads upon their sky.

At the peak of the "Honest John" advertising above Los Angeles last year several irate residents worked their city council members up to a point of attempting a legal ban against it. However, the cause of skywriting was saved when the California Aeronautics Commission stepped in with an opinion that skywriting is perfectly legal and that "Neatly executed signs in the skies are no more a desecration of nature than a roadside billboard." Of course, there are many who will contend that roadside billboards add nothing to the beauties of nature, and should be banned.

No advertising agency is more conscious of "public reaction" than Skywriting Corporation, and officers of the company go out of their way to drum up civic interest in their business. The company even goes so far as to train its pilots as public speakers, and spots them as banquet guests and on radio interviews. In fact, they gave 105 radio interview broadcasts last year.

Increasingly, there is a tendency toward stripping the business of all its mystery and hokum of other years.

But, there is one exception. A skywriter will gladly show you his plane, and explain how an oil and chemical smoke mixture is valved down to vaporise in a shroud surrounding the engine's hot exhaust stacks. He'll show you his grid cards. He'll explain the technique of timing his flight while tracing the letters, and the use of a tricky little solenoid finger switch to turn the smoke on and off. But, he'll not tell you what goes into the mixture he pours into his chemical tanks.

I asked Jack Moore of Skywriting Corporation for their formula, and received a polite regret that it is not for publication.

In Los Angeles, George Smith told me :

"We load up our planes with sixty gallons of a light oil having a high flash point, to which has been added five gallons of a bleaching chemical to give the smoke whiteness, and five gallons of a density chemical, to keep the vapour particles clinging together after they have been formed."

And then he added :

"That makes a good, believable explanation—even though it isn't the truth !"

HON... EY ?

The Air Hostess Told Us...

It was hot. It was getting hotter. It was Easter and no cloud in sight. "You can do that to some people some of the time," our Favourite Air Hostess was saying, "but you can't do that to all the people all the time—anyway, not to me." We were slightly bored and extremely lazy and pretended to be absorbed in deep and far-away thought. "Do you hear ?" Esmeralda was asking in a tone of voice that commanded attention, "in future, you will stop changing the stuff I give you to print, all my clever little comments about what's happening in the World of Aeronautics, and curb your desire to fiddle around with my copy merely because it does not suit your own taste." Okay, we said, we'll try it next time. "Next time nix," said Esmeralda, "now." She rummaged around in our desk, found the manuscript all ready for the "Our Air Hostess Told Us..." page, tore it up into small but unequal pieces, and carefully inserted her own manuscript in the file. "And don't you change my titles, either," she remarked over her shoulder as she left. The sun was shining, there was not a breath of air. So we let it go, and here it is—Esmeralda's page pepped up by Esmeralda.

I Miss my Husband Dreadfully
—Says Red-haired Ricarda
(After eight Months).

In a Vultee BT-13 war surplus trainer she has just bought for $600, lovely, luscious red-haired Ricarda Morrow-Tait will shortly make good her threat to return to her husband in England whom she left last August to start on a slightly ridiculous round-the-world flight in a small aircraft. The reason for her return seems to be her sudden, painful discovery, announced in a one-eyed hick-town in Alaska four months after her departure, that she loves her husband very much. It will be recalled that ex-model Morrow-Tait—Dicky to you—made a second crash-landing at Fairbanks, Alaska, in November and had to turn crooner in a nightclub near the Arctic circle to earn the cash necessary for another aircraft. That was her third crash. The first, harmless one occurred at Marseilles on August 20th. At the time of writing, Ricarda was on the way to scene of crash No. 2 in Alaska, from where she intended to resume one of the slowest round-the-world flights in the annals of aeronautics. (Read all about her forthcoming fourth crash in one of the next issues of Esmeralda's Page.) Her husband, incidentally, declared last February 19th that he was not at all mad at her. (Just wait until you get home, Dicky !)

"Fallen Angel" discovered
in flying love nest.

Through the sleuthing of Esmeralda, Our Favourite Air Hostess, the mystery of the big twin-engined airliner which circled for six hours over Catalina Island, Calif., yesterday has been solved. The occupants of this aircraft were millionaire playboy Reginald Q. Wolfe and one-time cinemactress Corinne Languor ("The Fallen Angel," "Pagan Nights," "Blue Passion"), now the wife of New York financier-industrialist Frank Sterling Buck. In a press conference this morning, Buck announced that divorce proceedings would start immediately. Miss Languor (formerly Priscilla Dudd) says she will contest the suit, even though she had always thought Buck was a perfect drip. She tearfully asserted that she and Wolfe were taking motion picture sequences from the air. As yet, no film has been produced in evidence. Informed circles say that the trial will turn on whether or not the aircraft had an automatic pilot. (Look for the next issue of Esmeralda's page for photographs of the aircraft's plush interior, including a blue-tiled bathroom and an orchid-coloured bedroom suite.) Upon hearing his wife's comments, Frank Sterling Buck rushed out of his offices, brandishing a service revolver and shouting "I'll... (turn to Page 17, Col. 3).

The Legal Side :
Place of Birth Aboard Aircraft—
Passenger Heads or Feet ?

A complex legal tangle is facing the operator of a Danish air ambulance service as a result of the birth of a seven-and-a-half-pound boy aboard one of its aircraft late in April. The aeroplane was peacefully cruising along at 180 miles an hour at 2,500 feet, somewhere between the small island of Samsoe in the Baltic and Copenhagen, when it happened. Legal experts have since been racking their brains to determine the "place of birth" to be entered on the birth certificate of young Knut. Is it to be Samsoe or Copenhagen ? The majority of the legal titans discussing the questions have come to the conclusion that, upon reaching the age of twenty-one, the most vitally interested party, said Knut, should be given the possibility of opting for either the place of take-off or the place of landing.

Meanwhile, Rancho Rio Grande Airways, large non-scheduled air carrier, has become involved in a somewhat similar yet entirely different case. It concerns the birth of a two-headed calf on one of the company's trans-Atlantic cargo aircraft. The company insists that the shipper pay additional shipping charges from the position where the calf was born, with which the shipper agrees. The navigator, who had assisted as midwife, attests that this was at 25 degrees 35 minutes West Longitude and 36 degrees 46 minutes North Latitude. The dispute arises out of the fact that Rancho Rio Grande Airways demands *two* fares for the animal. Says the company's President : "When we count our passengers, we count their heads, not their feet, as that gets us nowhere. We had a shipment of centipedes the other day." Legal experts from the International Civil Aviation Organization, the International Air Transport Association, the Civil Aeronautics Board, Ringling Brothers and Bertram Mills are converging rapidly on the scene. The problem is said to be already the subject of a thesis being prepared at the University of Harvard.

Disillusioned Paratrooper
Eludes Manhunt as Woman
Illusionist.

For the past three years a smart young woman dressed in pullover and pants has been touring the music-halls of Britain, eating fire in large quantities and in gay abandon and performing a number of intricate hat-tricks. Yesterday, top-of-the-bill Donna Delbert, the fire-eating woman illusionist, was arrested by U.S. Military Police as Private John Hill, a disillusioned paratrooper and deserter from the U.S. Air Force since 1945. She—he—she—he—*it* was immediately taken to Burtonwood air base, Warrington, England, given a hair-cut, stuck into uniform and is now awaiting court-martial or something. —You never know these days. Women wear pants, men wear pants, and because men wear pants like women they succeed in passing themselves off as women ; if they wore skirts, on the other hand, they wouldn't be able to pass themselves off as men. So the women have it both ways, as usual. Which shows that women are really the stronger sex and are therefore entitled to wear the pants.

ATAR 101 B Turbo-Jet Engine

The new French turbo-jet, the ATAR 101 B, is of the same power class as the Rolls-Royce " Nene, " de Havilland " Ghost " and General Electric TG-190. This size of engine—developing around 5,000 lbs. static thrust—is a favourite power plant for numerous aircraft now flying, under development or only projected. The ATAR 101 B, of which the initial series will go into production this year, has been built by the SNECMA (Société Nationale d'Etudes et de Construction de Moteurs d'Aviation) in Paris. The development work was done by a technical group of the Aéroplanes Voisin concern, headed by Mr. H. Oestrich. Test runs of the prototype engine were begun early last year on the new test beds erected at the Aircraft Engine Testing Centre in Melun-Villaroche. Flight tests are being conducted with a twin-engined Martin B-26 " Marauder" as flying test bench, which contains the experimental jet engine (with lengthened jet pipe) inside its fuselage.

Structurally, the ATAR 101 B is a " straight-through " turbo-jet engine, with a seven-stage axial-flow compressor, a single annular combustion chamber, a single-stage turbine and a " bullet " to permit variation of the jet orifice cross-section. The axial layout and judicious placing of the auxiliaries has permitted a very small diameter : the largest diameter, which is at the turbine flange, amounts to 34.9 inches, and there is a slight local thickening of 1.5 inches at the governing unit (see Fig. 1). This small diameter in conjunction with the short overall length (112 inches from air intake to jet outlet) greatly facilitates the engine's installation in an aircraft.

Fig. 1.

Dimensions and weights of the ATAR 101 B.

Max. diameter (at the turbine flange)	34.9 in.
Max. radius (near the engine accessories)	19 in.
Length (air intake to jet outlet)	112 in.
Jet orifice diameter (inside)	25.5 in.
Dry weight (with engine auxiliaries, without starter and airframe accessories aggregate)	1,875 lbs.
Weight of ATAR gasoline starter	77 lbs.

Performance

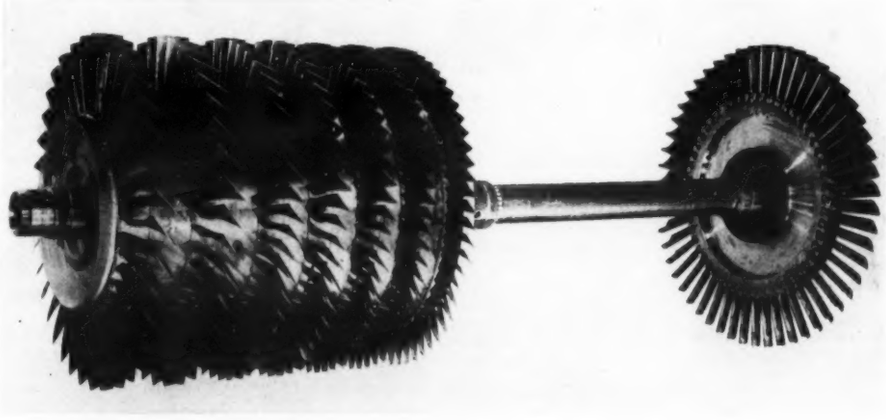
Max. static thrust at 8,050 r.p.m.	4,860 r.p.m.
Continuous thrust at 30,000 ft. and 560 m.p.h.	2,080 lbs.
Specific fuel consumption (static operation)	1.1 lbs./lb.hr.
Unit weight (referred to max. static thrust)	0.39 lbs./lb.
Specific frontal area (referred to max. static thrust)	0.197 sq.in./lb.

COMPRESSOR

The seven-stage axial compressor turning at its maximum speed of 8,050 r.p.m. reaches a compression ratio of 4.2 : 1, and works with a final pressure ratio of 50 per cent. At full r.p.m. the tip speed of the blades amounts to about 1,000 ft./sec. and the axial air velocity aft of the seventh stage is roughly 330 ft./sec. Efficiencies up to 88 per cent. have been recorded in test bed runs. High loading of the separate stages has enabled only seven stages to be incorporated, and has therefore permitted both the overall length and the weight to be kept small ; to further this aim, the stator blades are also used for converting velocity into pressure. Rotor, casing and blades of the compressor are all manufactured from light alloy.

The drum-type rotor (see Fig. 3) is built up from individual discs, suitably notched

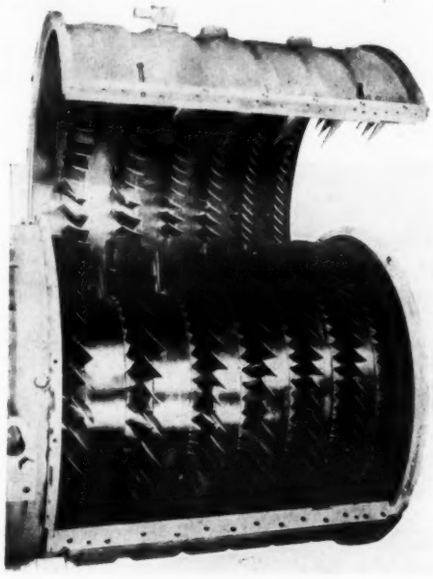
Fig. 2 : Complete rotor assembly : the turbine wheel and compressor rotor are connected by a hollow shaft.



into each other; the rotor blades have hammer-shaped roots which slide axially into corresponding slots in the periphery of the discs. To facilitate manufacture, the rotor blades of several of the stages feature the same profile and differ in length only. Stub shafts flanged on to each end run on bearings, the latter being ball types in front, in order to take thrust and transversal loads, and roller bearings at the rear. The two-piece compressor casing carries the stator blades, which are mounted on sections slid into the grooved casing. The stator blades, too, reveal the same profile in several of the stages.

Aft of the seventh stage is a row of discharge guide vanes, manufactured from welded steel sheet. In order to prevent icing, hot air is ducted through the streamlined nose cap and its four faired spokes, and also through the hollow inlet guide vanes of the compressor.

Fig. 3 : Compressor opened : the two-piece casing, stator blades and the compressor stator are of light alloy.



ANNULAR COMBUSTION CHAMBER AND ENTRY CASING

Between the compressor and the combustion chamber proper there is the combustion-chamber entry casing, which, apart from the ring of twenty burners and fuel injectors, contains the rear bearings of the compressor and the drives for the auxiliaries and oil pumps. The air streaming in from the compressor is divided into primary and secondary air at the combustion ring (see Figs. 4 and 5). The primary air alone streams through the burners, these being what are known as " cone burners " ; the secondary air is ducted elsewhere and not mixed with the gas until it has reached the annular combustion chamber. In each of the burners, the primary air produces a turbulent motion with back-flow, into which the fuel is injected at high pressure from the downstream-directed ATAR bi-quantity injectors.

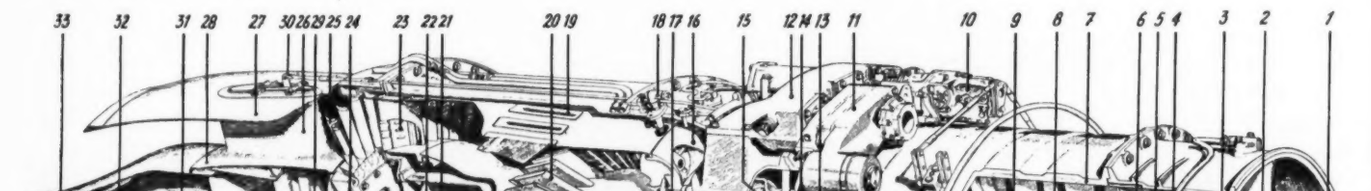
The annular combustion chamber is composed of several concentric steel-sheet cylinders (see Fig. 4). It is here that the secondary air is ducted, from the inside and outside, through forty hollow mixing vanes to the stream of hot gases, thereby enabling a favourable temperature distribution of the gas mixture entering the turbine to be attained. The annular configuration of the combustion chamber makes the best possible use of the small frontal area of the axial-type compressor, and makes for small flow losses, very complete combustion, easy ignition, and generally simple structural configuration.

TURBINE

The turbine part is designed for a medium degree of pressure conversion. At full r.p.m. the blade tips attain 1,115 ft./sec. ; the mean gas temperature at the inlet is 750 deg. C. (1,380 deg. F.).

The turbine wheel is preceded by an air-cooled ring of 29 entry guide vanes. The wheel itself (see Fig. 6) has 53 air-cooled blades. These have Laval-type roots which

Fig. 4 : Section through the ATAR 101 B.



F JET PIPE AND BULLET
26 Hollow fairing spoke (air-cooled, 8)
27 Outer ring
28 Inner ring
29 Pressure oil conduits
30 Control rods
31 Hydraulic servo motor
32 Adjusting rods
33 Bullet

D ANNULAR COMBUSTION CHAMBER
19 Outer mixing vanes (40)
20 Inner mixing vanes (40)

E TURBINE
21 Turbine shaft
22 Turbine bearing
23 Hollow guide vanes (air-cooled, 29)
24 Turbine disc
25 Hollow rotor blades (air-cooled, 53)

G ENGINE AUXILIARIES
10 Governor
11 Fuel pump system
12 Oil pumps
13 Oil conduits

C COMBUSTION-CHAMBER ENTRY CASING
14 Rear bearing of compressor
15 Engine auxiliaries drive
16 Burner ring (20 burners)
17 Cone burner with twin-nozzle
18 Ignition plug

B AXIAL-FLOW COMPRESSOR
7 Two-piece casing (with stator blades)
8 Seven-stage rotor (with rotor blades)
9 Discharge guide vanes

A COMPRESSOR ENTRY
1 Nose cap
2 Spoke
3 Righthand drive (for airframe accessories)
4 Front suspension point
5 Front bearing of compressor
6 Inlet guide vanes (hollow)

(Drawing by Paller)

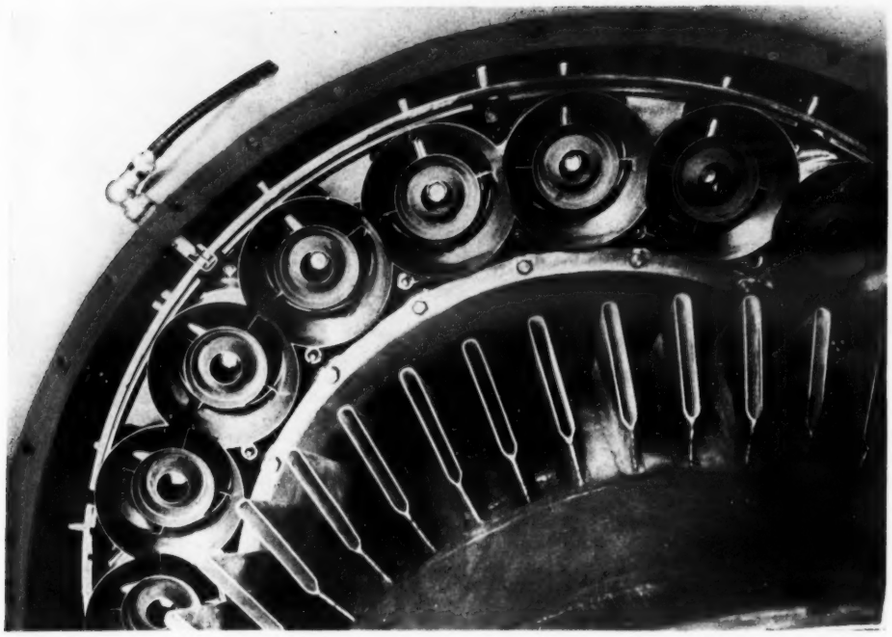


Fig. 5 : Combustion chamber opened : the outer steel-sheet jackets have been removed to reveal the burner ring (20 cone burners and twin-nozzles) and the secondary-air mixing vanes. At the top-left is one of the ignition plugs.

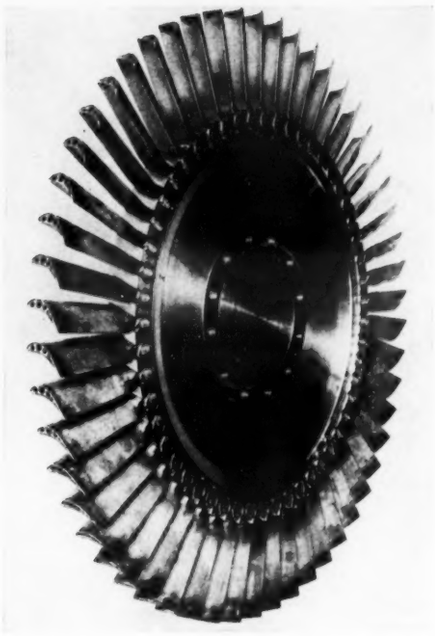


Fig. 6 : Turbine disc with hollow blades (steel).

are slid, under slight pressure, into cylindrical grooves in the turbine disc and secured by a ring against axial displacement. The disc, manufactured from weakly-alloyed martensitic steel, is flanged to the shaft by eight bolts, and overhung.

The guide vanes and turbine blades are built up from profiled jackets of heat-resistant steel sheet (Sirius HT) and internal sections of steel for ducting the cooling air, the latter amounting to about 2 per cent. of the total air mass flow. The blade structure is shown in Fig. 6. The profiled jackets are drop-forged from sheet sections decreasing in gauge towards the top, and subsequently welded along the trailing edge. Then the internal sections are inserted, two tabs at the foot of the blade are rolled around a cylindrical pin, and the whole assembly secured together by welding. Lastly, the blade root is milled and rectified.

Such hollow blades are cheaper to manufacture than solid types of the same size, which, as is known, have to be machined on all faces. Furthermore, the efficient air-cooling method enables weakly-alloyed steel sheet to be used, resulting in considerable quantities of nickel or other high-quality alloy elements being economised. On the other hand, air-cooled hollow blades open up new possibilities as regards higher working temperatures and, consequently, greater thrust. Their low weight gives rise to small centrifugal forces and inertia moments—and therefore a light overall construction and easier acceleration.

The turbine drives the compressor via a movable claw coupling and a long hollow shaft in such a way that part of the axial thrust is compensated. Furthermore, the design provides for a compensation of the pressures arising fore and aft of the compressor rotor, with the result that only a relatively small part of the axial thrust has to be taken up by the front bearing of the compressor.

JET PIPE

The cross-section of the jet pipe can be varied, 108.5 sq.in. being the difference between minimum and maximum area. The " bullet " (see Fig. 7), which is slid in axial direction by a hydraulic servo mechanism, is automatically adjusted to the best position for the specific engine state. An alteration of 15.5 sq.in. in cross-sectional area results in a change of about 10 per cent. in static thrust. In order to protect the adjustment mechanism from the effects of eventual overheating, cool air is blown by the exhaust stream through the eight hollow supporting spokes.

GOVERNING AND FUEL SYSTEM

The ATAR 101 B governing system keeps the r.p.m. and the gas temperature at predetermined values, regardless of the flying speed, altitude, and temperature of the air inhaled, thereby enabling maximum output to be obtained from every engine state. The r.p.m. is held constant, in accordance with the position of the throttle lever, by a centrifugal governor (fitted with a spring-loaded hydraulic servo), whereas the gas temperature is regulated indirectly by variation of the jet pipe cross-section (and by controlling the amount of fuel injected and the pressure differential at the compressor). This system allows for the provision of only one lever.

The total fuel supply is divided into a " basic supply " and a " main supply. " A centrifugal pump takes it from the tank through a filter to a high-pressure gear pump, which leads it to the regulator. Here, the " basic supply," which is maintained constant, is ducted (via a regulator) to the fuel injectors, whilst the " main supply " is varied by means of a distributing valve. The position of a piston inside the latter gives a direct measure for the amount of fuel injected ; this is used, on the one hand, for controlling the jet cross-section, on the other for measuring the fuel consumption. The ATAR bi-quantity fuel injectors assure complete atomisation, even at great altitudes or at idling r.p.m., when only a small amount of fuel is fed.

The bullet for modifying the cross-section of the jet orifice (see Fig. 7) is adjusted hydraulically, according to pulses from the temperature regulator, for which purpose a

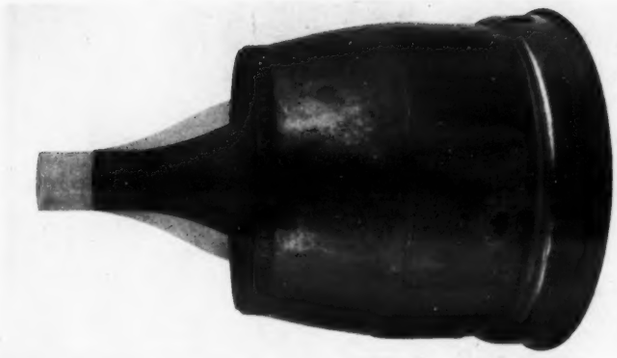


Fig. 7 : The jet outlet cross-section can be altered by means of a regulating "bullet," which is shown here drawn into the exhaust pipe; its furthest-out position is shown in silhouette.

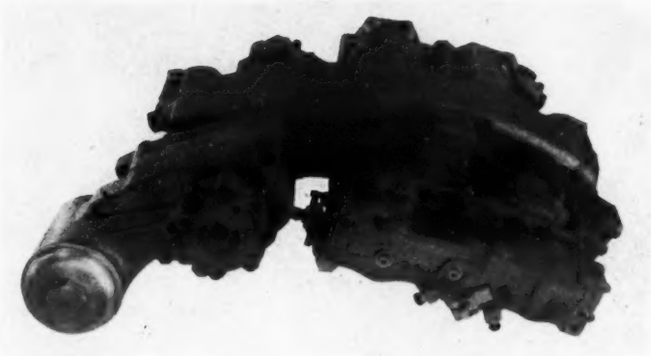


Fig. 8 : The engine auxiliaries aggregate is positioned on the entry casing to the combustion chamber; left-front is the fuel-pump system, near to it on the right is the governor, and behind are the pressure oil pump and the oil sprayer.

high-pressure pump supplies the necessary amount of oil. During the starting process, an electric pump supplies fuel to the twenty main injectors, as well as to two special starter injectors which are located in the vicinity of the ignition plugs. The pumps and the governor (see Fig. 8) are mounted on the upper side of the engine, and take up the least possible amount of space. The governing system is devised so that it can be utilised without modification on engines equipped with thrust-augmenting devices, such as water injection or after-burners.

LUBRICATION

The lubricating system is of the dry-sump type, and works with a feed pump and three scavenge pumps. The pumps form a single unit and are likewise fitted to the combustion-chamber entry casing (see Fig. 8) and driven by a vertical shaft. An oil distributor leads the oil to the spray-nozzles of the three main bearings to the intermediary gears and the governor. The governor has its own gear pump, which produces the necessary oil pressure. An oil/fuel heat exchanger and an oil tank can be positioned flat against the compressor casing. For the oil and fuel conduits, the manufacturers developed a reliably sealing and universally applicable type of elastic pipe which is easily mounted and is capable of absorbing any untoward tensions which might arise.

AIRFRAME ACCESSORIES AND STARTER ENGINE

On either side of the compressor entry casing there is a drive designed for a permanent output of 150 H.P. The aggregate for the airframe accessories (Figs. 9 and 10) is connected to one of them by an intermediate shaft in any direction to the engine. A 25-H.P. two-stroke gasoline engine for starting is flanged on to the aggregate. In this way it is possible, even when the turbo-jet is inoperative, to use the starter engine for driving the hydraulic and electrical systems of the aircraft as well as the suction and pressure air pumps. Thus even single-engined aircraft may benefit by the numerous advantages offered by an aircraft power system that is independent of the main power plant, which would otherwise have to be renounced for reasons of weight and space. The accessories aggregate and starter do not need to be dismantled in the event of the engine's being changed.

The ATAR gasoline starter engine furnishes 16 H.P. continuous power for driving the airframe accessories. To switch it over for this purpose, there is a gear and a clutch system, designed so that the accessories can be driven at full r.p.m. If a side-by-side installation of turbo-jets is provided, it is possible to use only one starter engine by suitably arranging the accessories aggregate (see Fig. 10), in which case the engines are started one after the other. The starting procedure is largely automatic, whereby a small electric motor of 0.5 H.P. starts up the actual starter engine. For starting, the fuel consumption amounts to only about 0.44 lbs., whereas a specific consumption of approximately 0.77 lbs./H.P. hr. occurs during constant operation for driving the airframe accessories. The ATAR gasoline starter, which weighs about 75 lbs. altogether, can also be applied to other types of power plant. Its cooling fan is so arranged that, on the ground, it can supply cooling air for the generator.

Fig. 9 : Installation of the airframe accessories aggregate (with air-cooled 25-H.P. starter motor) in single-engined aircraft.

Fig. 10 : One single airframe accessories aggregate and starter engine is all that is necessary for engines positioned side by side.

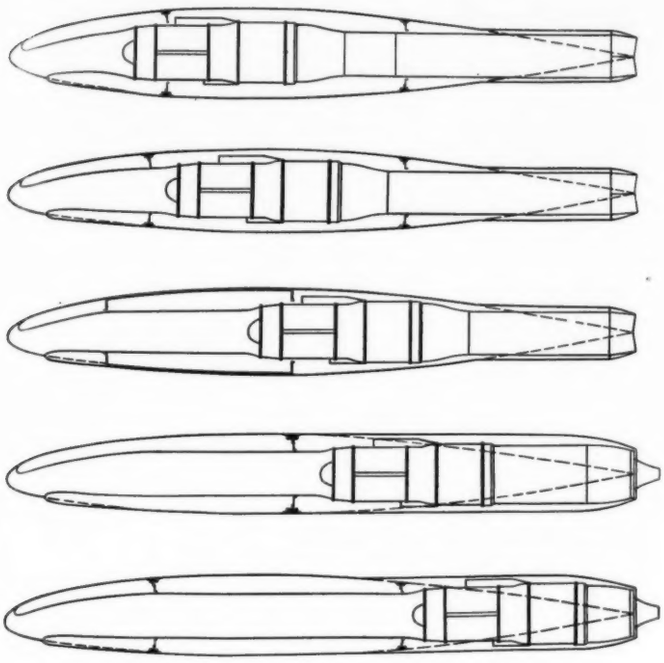


Fig. 11 : Possibilities of installing the ATAR 101 B inside a wing.

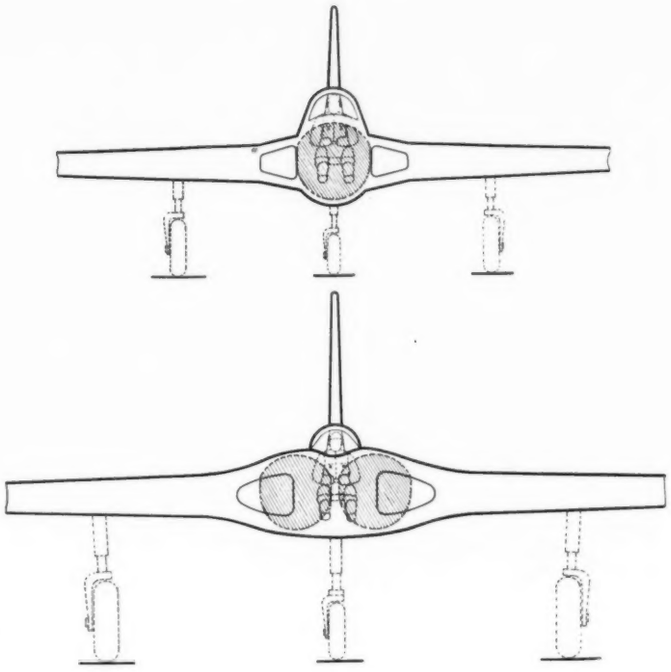


Fig. 12 : Two examples of how the ATAR 101 B turbo-jet can be installed centrally.

INSTALLATION

The principal suspension points are located left and right of the combustion-chamber entry casing, in the vicinity of the centre of gravity. Another four supporting points at the compressor entry can be used, if desired. The front mounting can also be realised at the flange of the inlet. The control-lever rods can be positioned, as desired, to the right or left of the engine. As the entire lubricating circuit is on the engine itself, it is necessary to connect together only the main and starter fuel leads. The couplings for the instruments are grouped on the right side of the engine, below the fuel pump.

During the installation, the cold and hot zones should be separated by a firewall and measures taken for appropriate ventilation. In view of the smooth exterior of the annular combustion chamber, there is no risk of fire breaking out. The hot rear part of the engine is cooled by air, and the ejector action of the outflowing gases assures adequate cooling, even during static operation.

The small diameter and the smooth, compact configuration of the ATAR 101 B permit a complete housing inside the wing or fuselage of highly streamlined aircraft. It allows for an especially thin fuselage when built into the fuselage of a single-engined type. The frontal area is so small that it is covered by the minimum dimensions of the cabin of a single-seater fighter (see Fig. 12). Also in twin-engined aircraft, the ATAR turbo-jet can be mounted so as not to prejudice the aerodynamics. In the case of four-engined transports (or bombers), the fact that this engine can be fully submerged in the wing makes for high speeds. When installed in a wing, these engines can, as Fig. 11 shows, be located inside or aft of the spars. This characteristic evinces special interest in connection with the application of swept-back wings.

MANUFACTURE AND ASSEMBLY

The engineers responsible for the ATAR 101 B turbo-jet attached extreme value not only to simplicity of manufacture and assembly but also to easy accessibility of all parts. Special equipment was developed for economic manufacture of the compressor blades, which allows for great precision in preparing the sharply twisted, thin profiles and can easily cope with the large output required of production manufacture. The turbine blades, of sheet metal, are manufactured quickly and cheaply. Also, the many other stamped and welded sheet-metal parts, as well as the extensive utilisation of standardised parts and the abstention whenever possible from over-precise adjustments, have enabled the manufacturing time to be reduced appreciably.

Finally, the adjustable exhaust orifice, fully-automatic governing, and the hollow, air-cooled turbine blades allow for various thrust-increasing measures to be applied—notably water injection and after-burners—thus paving the way for further improvement of the ATAR 101 B.

Fig. 1 : The Boeing XB-47 " Stratojet " high-speed bomber uses a 35-deg. swept-back wing to attain high Mach numbers and, with its six General Electric J-35 turbo-jets, should reach 620 m.p.h.

Where Do We Go From Here ?

Some problems facing the designer today

By Norman S. CURREY, Grad. R.Ae.S., Hatfield, Herts.

Where do we go from here ? That is the question aeronautical scientists are asking today all over the world. We are now, in effect, at the cross-roads of progress. Our problems—subsonic, transonic and supersonic — are manifold, the biggest of them all being the trans- and supersonic problem. Which is the best road to take for the supersonic region ? Should we use swept-back, swept-forward, or straight wings ? How are we to overcome the multitude of stability, propulsion, control and structural problems that face us as we contemplate this venture into the unknown ?

Our first objective is the transonic region, and beyond that the supersonic region. The former is our greatest unknown, for we have a good idea what to expect once we have exceeded the speed of sound, but only rough ideas about the transonic region.

Fig. 2 : The braking parachute of the XB-47 cuts down the landing speed and landing run. (The high-set-wing configuration was chosen because, when the aircraft is flattened out, the wing tips would otherwise risk touching the runway.)

Swept-back wings

Shall we use swept-back wings ? A definite answer cannot be given. It has some advantages, but also many disadvantages. Its one real advantage is that it delays the critical Mach number—the shock waves, instead of being perpendicular to the line of flight as they are for straight wings, are oblique, and lie at an angle to the normal flow about equal to the angle of sweep. The velocities at which they develop will consequently be measurably higher than those with perpendicular waves. In fact, compressibility is capable of being overcome by swept-back wings up to Mach numbers of 0.95 (see Fig. 1). This is admittedly a great advantage, but weighing heavily against it are the very many disadvantages and design problems—stability, low-speed performance, and structural.

The stability problem is probably the most important. The rolling moment due to side-slip, the so-called " dihedral effect, " can be expected to increase with C_L. The result is that oscillatory instability occurs unless ample weathercock stability is provided, and this is no mere theoretical argument, for we have already observed signs of this trouble on some tailless swept-back wing aircraft in low-speed flight, and when we combine this with the inferior rolling and wing-dropping tendencies, difficulties can be expected when approaching to land in gusty weather.

Wing tip stalling is perhaps the phenomenon of swept-back wing design most written and talked about. It is due to the air-flow being deflected towards the tips on the upper surface ; then, as it approaches the tips the tip vortices counteract this movement to form an accumulation of de-energised boundary-layer material. This layer, in thickening, separates from the wing surface to cause a premature stall; then as the aerodynamic centre moves forward, the incidence tends to increase still further, and decreases the static longitudinal stability. If the aspect ratio is decreased for a given angle of sweep-back, this unstable self-stalling characteristic tends to disappear ; for instance, from tests we have observed that for aspect ratios of 2, 4, 6, 8 and 10, the angles of sweep-back above which self-stalling is likely, are 54 degrees, 38 degrees, 25 degrees, 14 degrees and 5 degrees, respectively.

Another disadvantage of sweep-back—especially with tailless aircraft—is the poor $C_{L\,max.}$ value that can be obtained when flaps are lowered. Owing to their position relative to the centre of gravity, the elevons must be moved up to trim out the pitching moment. This counteracts to a great extent the extra lift from the flaps, resulting usually in a ΔC_L of about 0.2—yet another feature tending to increase landing speeds.

Methods of preventing wing tip stalling, particularly when approaching to land, provide many design problems—shall we use slats or boundary-layer suction? The former are not popular with designers of low-drag wings, for in addition to adding more mechanisms (for which the air loads are a very debatable point) to an already complicated wing, they may introduce difficulties as regards thermal de-icing. Boundary-layer control by either sucking or ejecting air in the vicinity of the flap hinge (see Fig. 3) seems to be a very promising method of assisting lateral control at low speed, but again we run into difficulties. To obtain a reasonable ΔC_L vast quantities of air are required: in one test it was observed that we required 500 cubic feet of air per second to obtain a ΔC_L of 0.8; in other words, a similar amount of air to that which is swallowed by a jet engine per second! The design problems incurred become immediately apparent, the main one being that of ducting. Furthermore, we must still retain a wing that will give safe handling characteristics if the suction fails.

The increase of wing structure weight owing to increase of structural span, and also elastic distortion at the higher speeds, are other peculiarities of swept-back wings. The aero-elastic effects have, in general, a detrimental effect on wing bending and torsion, as, owing to sweep-back, bending will cause a decrease in incidence and vice versa for torsion. Although they tend to counteract each other, the bending effect is usually the greater and a reduction in the slope of the lift incidence curve results, together with a forward movement of the aerodynamic centre. It is obvious, therefore, that a loss of longitudinal stability will occur unless great care is taken in the design stage. Furthermore, due to compressibility effects, the manœuvre point moves forward and, if combined with the above effect, may well lead to a very unstable aircraft at high speeds (see Fig. 10).

Fig. 4: The de Havilland D.H. 108 " Swallow " experimental high-speed aircraft, powered with one D.H. " Goblin 4 " turbo-jet, combines sharp sweep-back (43 deg.) with moderate aspect ratio (approx. 4.5). In September, 1948, it crossed the sonic barrier in a dive between 40,000 and 25,000 feet, attaining some 700 m.p.h. In April, 1948, it set a new international speed record of 605.23 m.p.h. (973.81 km./hr.) over a 100-km. closed circuit. John Derry was the pilot in both cases.

Apart from problems in the wing itself, sweep-back provides us with further problems in undercarriage design—as the sweep-back increases so does the stalling angle. This necessitates a longer and therefore heavier undercarriage, which has to be installed in the thin laminar-flow wing. Together with the increased structure weight involved, this tends to supplement the grey hairs already appearing on the head of the designer of swept-back wing aircraft. A possible solution may be found in the quadricycle landing gear adopted for the Boeing B-47, where two pairs of wheels in tandem are housed in the fuselage (see Fig. 2).

Fig. 3: The Armstrong Whitworth A.W. 52 tailless experimental aircraft, powered with two Rolls-Royce " Nene " turbo-jets, features a wing sweep-back of about 25 deg. The inlet slots for boundary-layer suction are visible in front of the elevons.

Swept-back wings of low aspect ratio

Wings of low aspect ratio — that is, of the order of unity (for instance, circular or square plan forms)—exhibit higher lift maxima than their counterparts of more normal proportions. In fact, it was observed in one case that a circular aerofoil, the aspect ratio of which was 1.27 ($4/\pi$), gave an increase of 50 per cent. in maximum lift over its normal counterpart with an aspect ratio of 6. What is more, the incidences at which this occurs are higher than the critical incidences of normal wings. The advantage therefore becomes apparent—the slope of the lift curve decreases at low aspect ratio, in addition to which we realise a greater maximum lift. It follows from this that wings of low aspect ratio result in a delayed stall, so much so that in one case the stall was delayed 12 degrees to 40 degrees merely by changing the aspect ratio from 6.25 to unity.

During the last war, Lippisch did a great deal of research in Germany, based on results obtained by Zimmerman of the N.A.C.A., and confirmed the satisfactory slow-flying properties that can be obtained by combining large sweep-back angles with small aspect ratios. If, for a moment, we separate the two, we observe the characteristic outward flow component along the surface of the swept-back wing resulting in a premature tip stall and tail-heavy pitching moment, whereas with the wing of low aspect ratio a pronounced inward flow component appears on the upper surface as a result of high induced drag. It seems, therefore, that if the two features were to be combined, we should realise satisfactory stalling properties, but only at the expense of high induced drag. An example of such a compromise solution is the de Havilland D.H. 108 " Swallow " experimental high-speed aircraft (see Fig. 4).

Sharply increasing the induced drag by reducing the aspect ratio, meanwhile, can lead to new difficulties at low flying speeds. If the elevons are moved up to reduce the speed we only increase the drag still further, causing a rapid increase in gliding angle with trimmed airspeed. If the pilot uses this method of approach he will make a very heavy landing indeed, as the aircraft will sink rapidly when the glide is checked. The only remedy is to make a fast landing, so increasing the landing run and adding to the dangers.

A radical solution to the problem of combining strong sweep-back with low aspect ratio is provided by the so-called " Delta " wing, a design used in the research aircraft of Consolidated Vultee (Convair 7002, see Fig. 5) and Martin-Baker (Fig. 6). The combination should lead to little or no tip stalling characteristic with a high critical Mach number. The latter advantage results from the use of a comparatively large chord, as do the structural advantages—it is com-

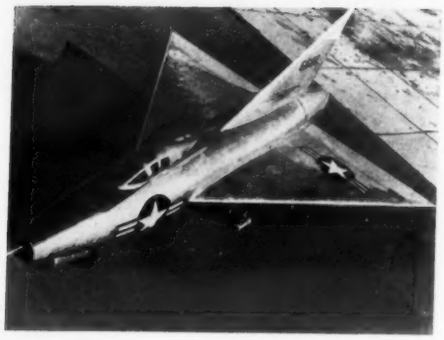


Fig. 5: The Convair 7002 experimental aircraft, designed for high subsonic speeds, has a "Delta" wing with a leading-edge sweep-back of 60 deg.

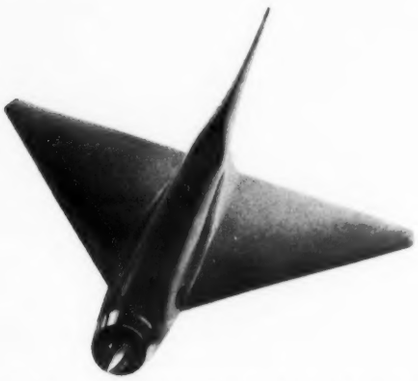


Fig. 6: Model of the "Delta" wing project of Martin-Baker Aircraft Co., the British firm.

paratively simple to design a wing of 10 per cent. thickness/chord ratio with good strength and structure weight properties. as *(a)* the chord is very large, *(b)* the span is not great, thus substantially easing the torsional stiffness problem, and *(c)* the span/depth ratio of the wing spar is quite small, thus simplifying the spar design from the strength point of view. In fact, considering the design as a whole, the "Delta" wing aircraft appears to be a very good proposition, structurally and aerodynamically, for attacking the transonic region.

Swept-forward wings

Swept-forward wings have not been used a great deal to date. One exception, for example, was the German Ju 287 (Fig. 7), a bomber of some twenty tons gross weight, which was powered with turbo-jets (either four Junkers Jumo 004s of approximately 2,000 lbs. static thrust each, or Heinkel-Hirth types of about 2,800 lbs.) and furthermore was equipped with powder rockets to assist the take-off.

Meanwhile, these wings have one important advantage over other varieties: while still retaining the delay in critical Mach number characteristic, there is no premature stall at the tips, as the spanwise flow component in the boundary layer induced by the sweep of the leading edge carries stale boundary-layer material to the wing root on the upper surface, so causing a stall to start at that point—a very desirable feature. If no wing twist or other device is incorporated, the stall will then spread from there to the tips. But here, as with swept-back wings, we experience a decrease in longitudinal stability. Also, the inherent directional instability of swept-forward wings demands some type of fin for weathercock stability, and greater fin area to stabilise the fuselage. The tailless configuration is, therefore, not applicable here.

Nacelles

The main advantage of swept-back wings —delaying the critical Mach number and making higher speeds possible—can be offset completely if buffeting arises due to disturbed air leaving the fuselage-wing attachments and the nacelles. This trouble was experienced with the Gloster "Meteor" (admittedly not a swept-wing aircraft, but suitable for this instance) and was overcome by extending the nacelles, so increasing the buffeting speed from a Mach number of 0.74 to 0.85. Good design of the body and nacelles is, it seems, all-important from the critical Mach number point of view. The correct design of nacelles can only be decided by extensive research, both in wind tunnels and flight; but one thing is certain—if possible, they should be completely buried in the wing, or should be so well faired, so as to be considered part of the wing itself. An alternative is to sling them well below the wing as on the Boeing XB-47, so leaving a thin wing which is virtually unaffected by disturbed air-flow round the nacelles.

Aerofoil sections

What type of aerofoil section are we to use for penetrating the sonic barrier and exploring the supersonic region? Obviously we are faced with an entirely different design problem from that of subsonic operation. Perhaps before discussing the matter any further it would be advisable to list the respective requirements for sub- and supersonic flight.

Subsonic requirements:

a) camber largely decides C_L value;
b) drag increased by low aspect ratio, though
c) drag almost independent of thickness/chord ratio;
d) centre of pressure at 25 to 30 per cent. chord;
e) downwash affects stability.

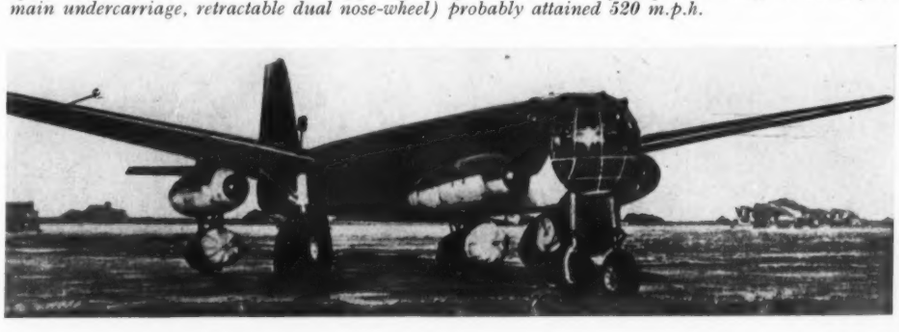
Supersonic requirements:

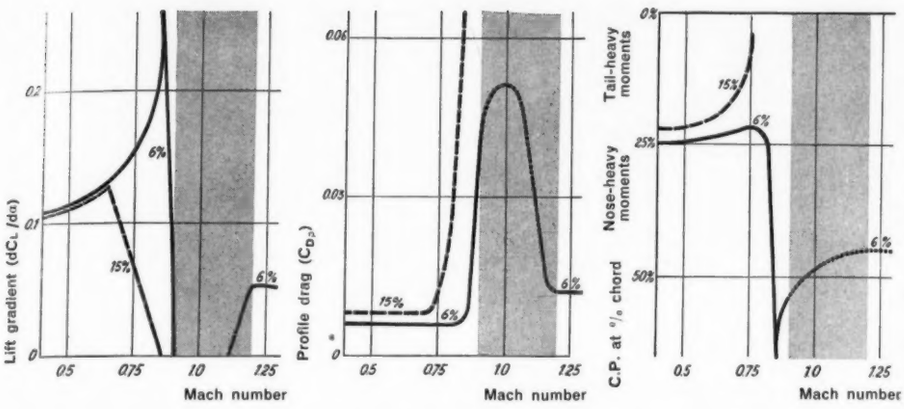
a) lift not affected by camber;
b) drag independent of aspect ratio, though
c) drag proportional to thickness/chord ratio;
d) centre of pressure at 50 per cent. chord;
e) shock wave at trailing edge prevents formation of downwash.

To satisfy the subsonic requirements the present type of aerofoil suffices, with the old convex aerofoils gradually changing to symmetrical sections of about 10 per cent. thickness/chord ratio as the speeds increase. For the supersonic region a double-wedge aerofoil of 5 to 10 per cent. thickness/chord ratio is indicated, though, unless some form of low aspect ratio wing is used, the structural problems will become appreciable. The main disadvantage lies in its low-speed characteristics, for although they would be ideal for supersonic work, the aircraft would still have to be capable of flying at low speeds for landing and taking off. The previously-mentioned boundary-layer suction may be one method of overcoming this to a certain extent, but this again provides more complications, particularly in view of the ultra-thin wing.

The transonic region still remains the great unknown, however. We know with reasonable certainty what to expect in the supersonic region, but as Figs. 8, 9 and 10 show, we are still not quite clear about the effects of the transonic region on lift, pitching moment and drag. We do know that present-day laminar-flow aerofoils, with their maximum thickness at 50 per cent. chord, can successfully negotiate this region, but only at very great risk, due to shock-wave formation causing very violent changes of air-flow.

Fig. 7: A forward-sweep of about 20 deg. was revealed by the wing of the German Ju 287 high-speed bomber, of which the prototype (four Jumo 004 turbo-jets plus take-off rockets, fixed main undercarriage, retractable dual nose-wheel) probably attained 520 m.p.h.





Figs. 8, 9 and 10 : Curves of lift gradient, $dC_L/d\alpha$ (in degrees), profile drag and centre of pressure (pitching moment) of a symmetrical aerofoil section of 6 per cent. thickness/chord ratio, at small angles of incidence, on either side of the sonic barrier. For purposes of comparison, the values of the same section with 15 per cent. t/c ratio are plotted for the subsonic region (dashed lines) ; the dotted lines indicate the presumable variation of the values in the unexplored transonic region. (See " Effets de la compressibilité " by F. Feldmann in Vol. I, No. 1, pp. 55-62 of INTERAVIA.)

The most dangerous effects, illustrated by the curves, are the sudden reversal of lift and nose-down change of trim at the critical Mach number. In actual flight, the pilot finds his aircraft going into a dive from which he cannot pull out by elevator, so he has to trim out of it. After falling into the lower air levels, the speed of sound has risen and the lift suddenly returned, enabling him to trim out. This results in a very violent pull-out which may well break up the aircraft.

Where do we go from here ?

The above remarks on the manifold problems of high-speed flight on both sides of the sonic barrier reveal the complexity involved. As, furthermore, all these difficulties arise almost instantaneously as soon as an aircraft nears the sonic limit, one is apt to wonder whether or not it would be far better to consolidate our present position before making any further hazardous advances. Piercing the sonic barrier is still in the nature of an adventure nowadays, and there is no doubt that a great deal of minute research work will be necessary before the problems of general stability, tip stalling, structure weight, aero-elasticity, etc. are reliably clarified. But these problems might be investigated with wings having moderate sweep-back, which allow only a slight delay in critical Mach number to be realised. Once the national pride of the air-faring countries has been satisfied by their own flights into the supersonic region, there should be a general return to the basic problems and an endeavour made to investigate, through steady research, those domains over which we have flashed so courageously. In other words, let us adopt the Roman motto of *festina lente*.

The 200-H.P. Boeing Model 502 Gas Turbine

By S. D. Hage,

Propulsion Development Unit Chief, Boeing Airplane Co., Seattle, Washington [1]

Probably the first question that comes to mind is why the Boeing Airplane Company is interested in small gas turbines. The answer is fairly simple. In late 1943 the Army Air Forces requested proposals for a high-speed, turbojet-driven, medium bomber. It was evident that this type of machine would open a new era in air transportation and that the development of such a machine was a major problem encompassing new and unknown concepts. Now, regardless of the fact that time and material costs are adequately covered on such a development, there is a tremendous investment in new " know how," and profitable operation is not possible unless the product of such effort is a useful article for production. Long experience has taught that the best insurance for a useful product is a thorough understanding of all the design and operational aspects. One of these problems, as far as the Boeing Airplane Company was concerned, was the gas turbine engine. In fact, the field was so new that obtaining sufficient information from engine manufacturers was not considered practical. It was therefore decided that this new type of engine must be thoroughly studied.

Over the next few years this study progressed through an analytical stage, then a stage in which test data were obtained on compressor, burner and turbine, and finally on all three combined into a *bona fide* prime mover. In order to keep the cost of this work to a practical minimum it was all done to a relatively small scale. The aircraft that was previously mentioned is now known to the industry as the B-47. By the time the broad aspects of the gas-turbine study had been satisfied to the extent that it was no

[1] Presented on January 11th, 1949, at the Annual Meeting of the Society of Automotive Engineers, in Detroit. Published with permission of the author, the Boeing Airplane Co. and the S.A.E.

Fig. 1 : Boeing Model 502 gas turbine : on the right, in front, are the air intake and compressor, followed by the accessories drive box and, on the latter's left, one of the two combustion chambers ; further aft are the turbine casing and the two exhaust outlets.

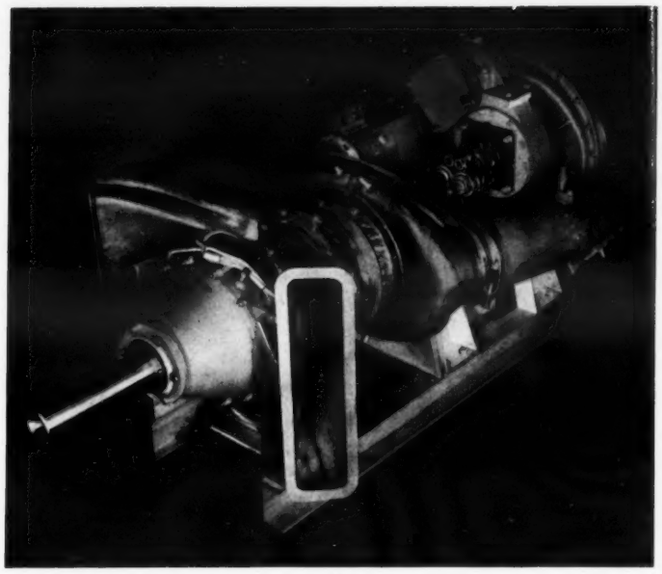


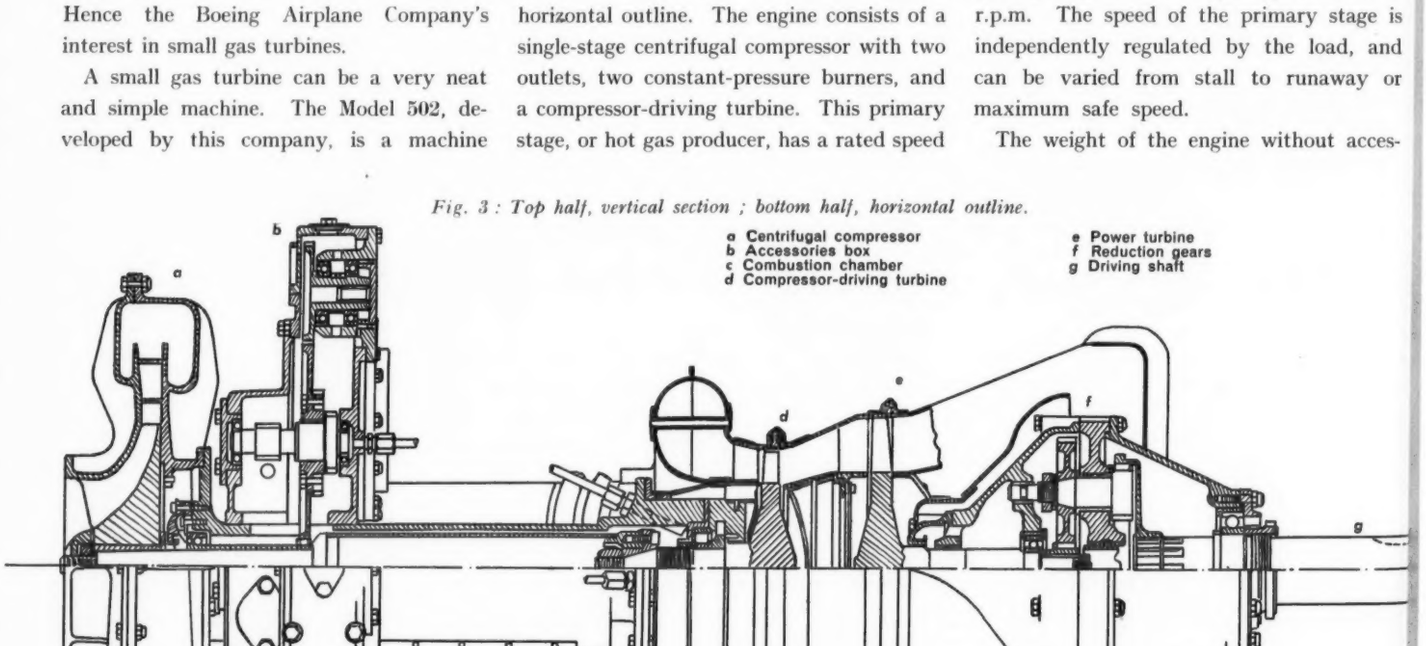
Fig. 2 : View from the turbine end. The power turbine wheel is visible through one of the exhaust outlets.

longer B-47 insurance, it had produced a semi-developed engine. In addition, it had provided an understanding of this type of engine, which promised a useful market—of unknown size, but of certain existence. Hence the Boeing Airplane Company's interest in small gas turbines.

A small gas turbine can be a very neat and simple machine. The Model 502, developed by this company, is a machine accenting simplicity. Figure 1 is a three-quarter view from the compressor end, and Figure 2 a three-quarter view from the turbine end. The top half of Figure 3 is a vertical section, and the bottom half a horizontal outline. The engine consists of a single-stage centrifugal compressor with two outlets, two constant-pressure burners, and a compressor-driving turbine. This primary stage, or hot gas producer, has a rated speed of 36,000 r.p.m. and drives the accessories. The secondary or power output stage consists of another turbine with a rated speed of 24,000 r.p.m., and a 9.6:1 reduction gear, giving a rated output speed of 2,500 r.p.m. The speed of the primary stage is independently regulated by the load, and can be varied from stall to runaway or maximum safe speed.

The weight of the engine without acces-

Fig. 3 : Top half, vertical section ; bottom half, horizontal outline.



series is approximately 150 lbs. The power output will vary between 100 and 200 B.H.P., depending on the endurance life expected. The rated specific fuel consumption will vary between 1.5 and 1.0 lbs./B.H.P.hr., depending on the rating and the degree of component refinement possible. The engine is extremely easy and consistent to start ; it can develop rated power fifteen seconds after the start is initiated. It can accelerate very rapidly, going from idle, which is about 10,000 r.p.m., to full speed in five seconds. It is practically free from vibration, if the rotating parts are accurately balanced ; destructively rough if not. The basic simplicity is well illustrated by the accompanying table, which shows a comparison of the number of parts and the number of running machined fits, with other engines.

	Boeing 502 Gas Turbine	Lycoming 0-435-2 Aero Engine	Gray 64-HN-9 Automobile Engines	Waukesha 6 WAK Automobile Engines
Part numbers in engine	175		590	
Number of parts in engine	220		1,400	
Complete overhaul parts list	20	160	210	150
Number of close tolerance running fits	16	100	135	100

Standard parts, such as nuts, bolts, sealings, etc. are not included.

Figure 4 illustrates some of the important performance characteristics, and their comparison with other engines. Two types of load are shown by the dotted lines : a grade load representing one extreme in load type, and an air-friction load the other extreme. It will be noted that the B.H.P. curve for the Model 502 provides considerably more excess power for acceleration than the reciprocating engine, for either type of load. In addition, the gas turbine cannot be stalled. This is also shown by the torque curves. The reciprocating engine torque falls to zero at zero speed. The Model 502 stalled torque is twice the rated speed torque. The solid curves for specific fuel consumption are shown for maximum power at any speed. The dashed curves for specific fuel consumption are for an air-friction or cubic load. It is interesting to consider that the best economy point for any power, in the case of the Model 502, lies on a cubic load curve. Since such a load is very characteristic of most power requirements in the transportation field—land, water and air—this type of engine is admirably suited, without any complicating load varying devices. It should be emphasised that a gas turbine without a free power turbine is not very suitable for general applications. The direct connected machine has a maximum power characteristic very close to the air-friction load curve and will stall if loaded below about 40 per cent. speed.

Offsetting some of the desirable features of a small gas turbine previously mentioned are some features that should be discussed. The air consumption is very high, and large intake and exhaust friction losses are not tolerable. The author has not yet seen a clean solution to the compressor inlet noise problem. This silencing problem is especially difficult because of the large flow and the necessity for very low pressure drop. The idle fuel consumption is high, roughly one-fifth full power consumption. The development cost is high. This is primarily the result of having to solve so many new problems along with the general run of mechanical problems that plague any new piece of machinery.

However, it seems inescapable that the small gas turbine will be a better solution to many of our power applications than any we have now. These troublesome current problems, previously mentioned, will be solved. It the fullest advantage is taken of the reduction in engine and installation weight possible through the use of a simple engine like the Model 502, many vehicle applications can be better solved even in the face of the current fuel consumption. Production costs are unknown, but it seems most reasonable that they will be less per horsepower than reciprocating engines. In addition, the prospects for future improvement through development are very good, both as to fuel consumption and power-weight ratio. Component refinement will pay off in both.

The use of regenerative heat exchangers will pay off well in fuel consumption, at the expense of power-weight ratio. Figure 5 shows a plot of H.P./lbs.sec. (primarily affecting machine size) and thermal efficiency (η_0), against cycle pressure ratio (p_2/p_1), for various inlet temperatures (T_I), nozzle box temperatures (T_G), compressor efficiencies (η_c), turbine efficiencies (η_T), and regenerator effectiveness (ϵ). It can readily be seen that the upper practical limits for this type of engine are very high indeed, and are worth reaching for.

Figure 6 is a diagram of the Model 502 with regenerative heat exchangers. Doubling engine weight would reduce fuel consumption

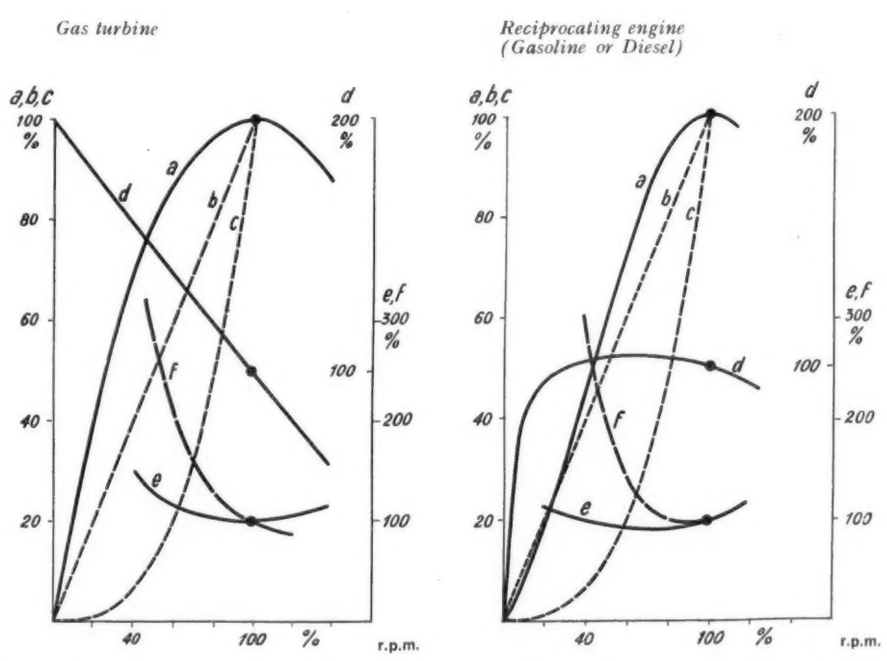


Fig. 4 : Power, torque moment and specific fuel consumption characteristics, compared for gas turbine and reciprocating engine, versus r.p.m.

a Maximum delivered power
b Power requirement with grade loading
c Power requirement with air-friction load
d Torque moment
e Specific fuel consumption at maximum power
f Specific fuel consumption with cubic increase of power

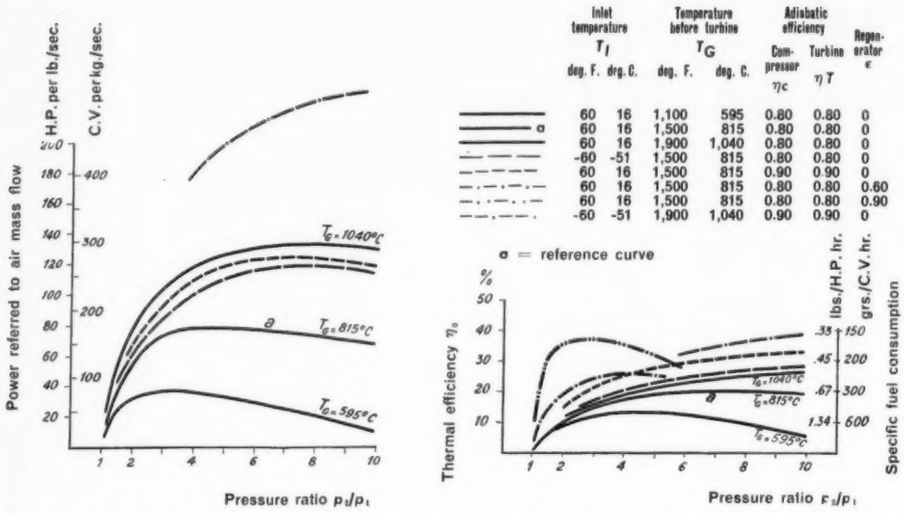

Power referred to air mass flow
H.P. per lb./sec.
C.V. per kg./sec.
Pressure ratio p₂/p₁
Thermal efficiency η₀
Specific fuel consumption
lbs./H.P. hr.
grs./C.V. hr.
a = reference curve
Inlet temperature T_I deg. F. deg. C.
Temperature before turbine T_G deg. F. deg. C.
Adiabatic efficiency Compressor η_C Turbine η_T
Regenerator ε

Fig. 5 : Power and consumption of gas turbines versus pressure ratio p_2/p_1 between combustion chamber and ambient air.

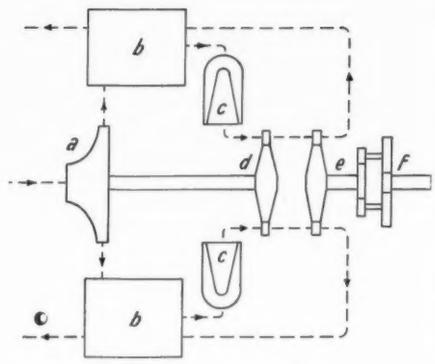


Fig. 6 : Simple cycle with regeneration and free power turbine. Pressure ratio 3 : 1.

a Compressor
b Regenerator
c Combustion chamber
d Compressor-driving turbine
e Power turbine
f Reduction gears

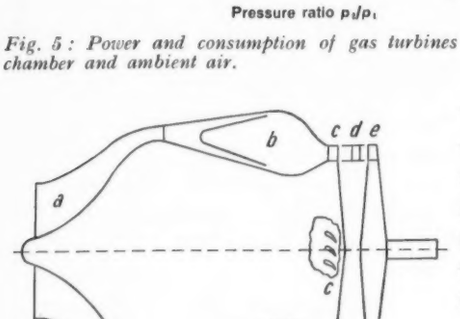


Fig. 7 : Arrangement with rotating compressor-combustion chamber-nozzle assembly and free power turbine.

a Compressor
b Combustion chamber
c Nozzle
d Guide vanes
e Power turbine

by 25 per cent. This trend will be followed where fuel consumption is a primary consideration. Since regenerators are basically static structures, a design which properly takes care of thermal strains should be relatively inexpensive to build and maintain. Figure 7 is a configuration suggested many years ago in Germany, which is interesting in that such high compression and expansion efficiencies would be possible, though the rotational stress problems for a good pressure ratio would be very serious. Figure 8 is a configuration which approaches Carnot Cycle efficiency as a limit. In addition, it makes use of relatively small pressure ratio per rotor, which, in a dynamic machine, is believed to be very important for retaining operational flexibility.

The last three figures have been presented to illustrate what the future promises. However, current thinking should be concerned with honest evaluations of the benefit that can be derived from the proper application of the current engine. There is no doubt, in the author's mind, that many very valuable applications will be overlooked for some time because our thinking is so geared to past habits, and we are continually looking for something that is better on all counts. This is a new machine, and does not necessarily have to make our present vehicles better, but will result in different but better vehicles, for the same transportation problem. Westinghouse or General Electric turbo-jet engines, installed in a DC-3 or B-17, as nicely as you please, would leave much to be desired for a better transportation vehicle. However, these same engines are now installed in aircraft which are especially designed to utilise these new power plants; and these aircraft outperform our wildest dreams of five years ago.

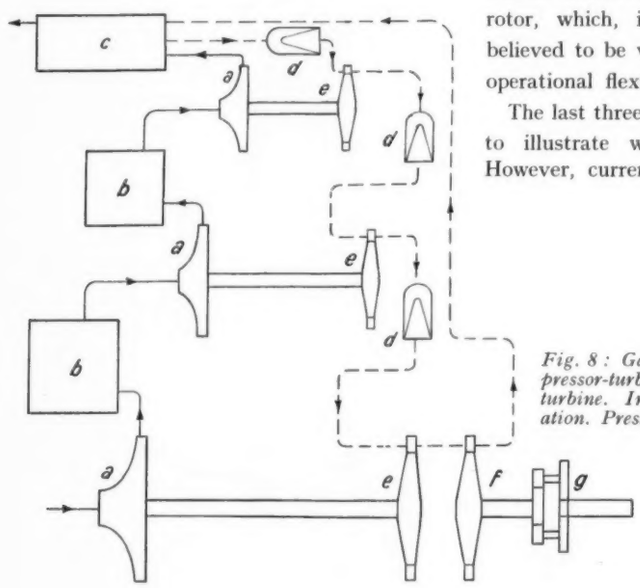


Fig. 8 : Gas turbine plant with three compressor-turbine stages and free power turbine. Intercooling, reheating, regeneration. Pressure ratio 25 : 1.

a Compressors
b Intercoolers
c Regenerator
d Combustion chambers and reheaters
e Compressor-turbines
f Power turbine
g Reduction gears

Domestic Bliss and Excess Luggage

It is not that I have any serious objection to air travel, but I must say that, in my opinion, the airline companies are too strict about the amount of luggage each passenger can take. In my part of the world we are allowed only twenty kilograms, which I think constitutes a weighty argument against going by air... to such a point, in fact, that when my wife and I recently decided to take a short holiday, I told her flatly we would patronise the railways, which were slower but more generous.

My wife, being a girl with modern ideas, protested. I didn't listen to every word of her argument, but I remember she complained with great gusto about smoke, soot, noise, dirt in her eyes, and so forth.

At the moment I saw she thought she had squashed me, I dealt my trump card: "I suppose you know that, if we go by plane, you can't take more than one change of clothes."

It worked like a charm.

"In that case, we'll go by train," she said, very definitely, and promptly left the house to pay a farewell visit to an old schoolfriend.

The time, by the way, was two o'clock in the afternoon. This detail is rather important.

At seven o'clock my wife had still not returned home. Then just as I was about to pour myself a spot of consolation, I was deafened by an unholy rumpus emanating from around the front door. An instant later my wife burst into the room, laden with parcels. This seemed to be an ill enough omen, until a few seconds later I perceived an errand boy, carrying still more parcels, laboriously making his way through the door.

"What the dickens have..."

"I've got a lovely surprise for you," interrupted my wife.

"I'll say you have."

"Yes, just imagine that, when I told Henrietta what you said about the luggage restrictions on aircraft, she replied that you must have been mistaken. She took a plane trip a few weeks ago, you remember, and the company gave her this little pamphlet containing useful information."

Upon which she brandished the said pamphlet before my eyes. As I feared, the "useful information," compiled by a man whose first name I'm sure is Judas, gave an endless list of articles of feminine apparel which would not exceed twenty kilograms.

"So, you see, I had to complete my wardrobe."

Flabbergasted by this piece of feminine logic, I quickly tipped the errand boy and told him to beat it before I started throwing things.

"So you had to complete your wardrobe," I repeated, like a character by Hemingway.

"Yes, and its a lucky thing I had Henrietta to help me choose things. There was so little time."

Just as I was about to expostulate something juicy about Henrietta, the doorbell rang. It was Henrietta.

"Darling," she exclaimed sweetly to my wife, whilst giving me a sour nod of recognition, "you forgot this."

She held out another parcel.

"What, you've not finished yet ?" I exclaimed, explosively.

"It's only my new bathing suit and parasol."

"But we're right in the middle of winter, and we're travelling northwards," I almost screamed.

"Exactly, it's a new one for next summer. You see how careful I am to be ready in time... provided the fashions don't change, of course."

I made a grab for the accursed pamphlet which had caused all the trouble. Just as I was about to rip it to bits, my eye caught a list headed "Men's apparel." "Two suits, three pairs of shoes, eight shirts..." An idea occurred to me.

Early next morning I got up before my wife, flung open both doors of the wardrobe and started pulling out the garments one by one as they were listed in the pamphlet, packing them into a suitcase. My wife sat up with a start.

"Whatever are you doing ?" she asked.

"Just obeying the list, darling," I retorted.

"But what are you going to do with all that ?"

"I'm going to sell it all, to make up for everything you bought yesterday. List for list, and we'll be quits."

I closed the suitcase and made for the door. My wife then started crying, calling me a heartless brute.

"All right, all right," I said gently, "I suppose you've learned your lesson by now. You must have lost your head yesterday."

"Yes, darling," she blurted out between sobs, "I'll send some of the things back."

"What, for instance ?"

"The bathing suit and the parasol."

"Is that all ?" I asked exasperatedly.

"But it's a wonderful idea, darling. I'll then be able to take another three frocks I bought last week without telling you, and they'll just make up the difference in weight."

Yves Grosrichard.

Freight Soars

Look up—it might be loaded!

At the end of June, 1947, a British expert on shipping wrote as follows on the prospects of the tramp ship market:

"The competition of the air has not become so acute as one would have imagined—as aeroplanes are, and probably always will be, unsuitable for carrying any description of cargo except the lightest and most valuable traffic—but it will supersede sea transport for passengers for distances such as the Americas, South Africa, Australia, and the Far East.

"Even in Great Britain I consider the time will come when small aeroplanes capable of covering some 200 miles per hour will operate between London and other large ports and towns, enabling one to leave home in a morning and, after a day's business in London, or elsewhere, arrive home in time for dinner—in fact, I foresee the time when persons will own and use and drive their own 'planes as we now do motor-cars."

These lines appeared on July 3rd, 1947, in *Fairplay*, a leading British shipping journal. A few days later an aircraft took off from Bovingdon aerodrome bound for Calcutta. Among other things it carried a ship's propeller shaft urgently needed to repair a cargo vessel lying disabled in Calcutta harbour. Every day of enforced idleness was costing the shipping company an estimated £200. Roughly at the same time there appeared, in French newspapers, advertisements inserted by a transport firm in Rheims, which specialises in international transportation by air of furniture. And scarcely a year later sacks of coal were rattling in and out of every loading hatch of the aircraft flying the Berlin Airlift... The above shipping expert, with his prophecy, had not exactly scored a bull's eye.

Another ten months went by. If that shipping expert had read the issue of March 3rd, 1949, of the *Journal de la Marine Marchande*, which is published in Paris every Thursday, he would have found, under the regular heading "Air Freight," a condensed review of the commodities offered for transport by air during that week at the air freight exchanges of Paris, London, Antwerp, etc. The lightest and most valuable traffic? In a way, yes. Each month, for instance, a ton of gold is flown from Lisbon to Geneva. But commodities are also listed which can be called neither light nor valuable: 150 cows from Amsterdam to Lydda, 8,400 lbs. of spares for British ships to Hong Kong, 15 tons of fertiliser from Milan to Tehran, 6,200 lbs. of woollen goods from Hamburg to Tehran. Chartered aircraft are also sought for carrying persons. Only, these persons are by no means Managing Directors who, having finished their day's business in Sheffield, wish to fly by private 'plane back to London, but concern "30 sailors from Bombay to London... 30, 40 and 50 sailors from Johannesburg to Stavanger."

Lettuce examine the matter...

When evaluating the advantages of air transport the average businessman usually thinks only of the considerably shorter travel time of the finished product. In this way he arrives at entirely inadequate conclusions. But even if he is acquainted with all the other arguments generally offered in favour of air transport (shorter-term investment of capital, lower insurance costs, elimination of expensive crating and processing, reduced risks of theft, deterioration and damage), he still cannot obtain an absolutely complete picture of the radical changes being brought about by air-freighting in the transportation of numerous goods, and even in the production of these goods.

We are obliged to the U.S. Department of Agriculture, and notably to R. W. Hoecker of the Department's Bureau of Agricultural Economics, for having made the first thorough study of the branch. In the middle of the war preparations were made which led to one of the most informative studies conducted in the domain of airfreighting ("Air Transport of Agricultural Perishables." Miscellaneous Publications No. 585, U.S. Department of Agriculture, January, 1946.)

The Americans went to work with their characteristic thoroughness and open-mindedness. They investigated the absolute costs of transporting agricultural products by air and compared them with the costs incurred

A 14,275-lb. steel skeg, one of the heaviest single-unit shipments ever airfreighted commercially, arrived in Rome from New York on March 18th, 1949, aboard a DC-4 of Seabord & Western Airlines, Inc. Shown here being unloaded under supervision of Italian officials, the skeg, or lower stern frame (which supports the ship's screw and rudder), was ordered for emergency repairs on the Italian oil tanker "Ambronia," damaged in a collision in the Mediterranean. It is 18 feet long and has a seven-foot projection jutting from the main shaft about half-way down. It was estimated that airfreighting the skeg reduced the "Ambronia's" enforced idleness by at least a month.

Six Pratt & Whitney engines receive their aerial baptism in a transport plane of Seaboard & Western, who fly spares to Frankfurt for aircraft flying the Berlin Airlift.

by surface transportation media. They examined the capacity of the available and anticipative air fleet of the U.S.A. Neither did they forget the questions of ground organisation, nor those of field-to-airport carriage. Above all, however, they conducted the first thorough study of the influence air transportation can have on the reaping, storage and crating of agricultural commodities. And they arrived at some astonishing conclusions.

Incidentally—some of the unconservative methods of investigation used by these officials, yielded startling results. Probably the most interesting piece of market analysis was the "Lettuce Test" of June and July, 1944.

On every market day during one month the Department had large quantities of lettuce supplied by railroad and aircraft to Detroit, where it was displayed in two stores as "rail-borne lettuce" and "air-borne lettuce." In two other stores it was displayed without identification of how it had been transported. It was seen that when customers were not informed of the transport medium used, they preferred to buy the "air-borne lettuce" because it looked fresher, although it cost 5 cents more than that sent by rail. If, on the other hand, the transport medium was made known, the seemingly conservative housewife went for the "rail-borne lettuce," despite the fact that the Department had partly paid the difference in price out of its own funds.

*

Fascinating as this diversion into customer psychology is, the conclusions reached on the influence of the aircraft on the costs involved in reaping and crating the products appear far more significant.

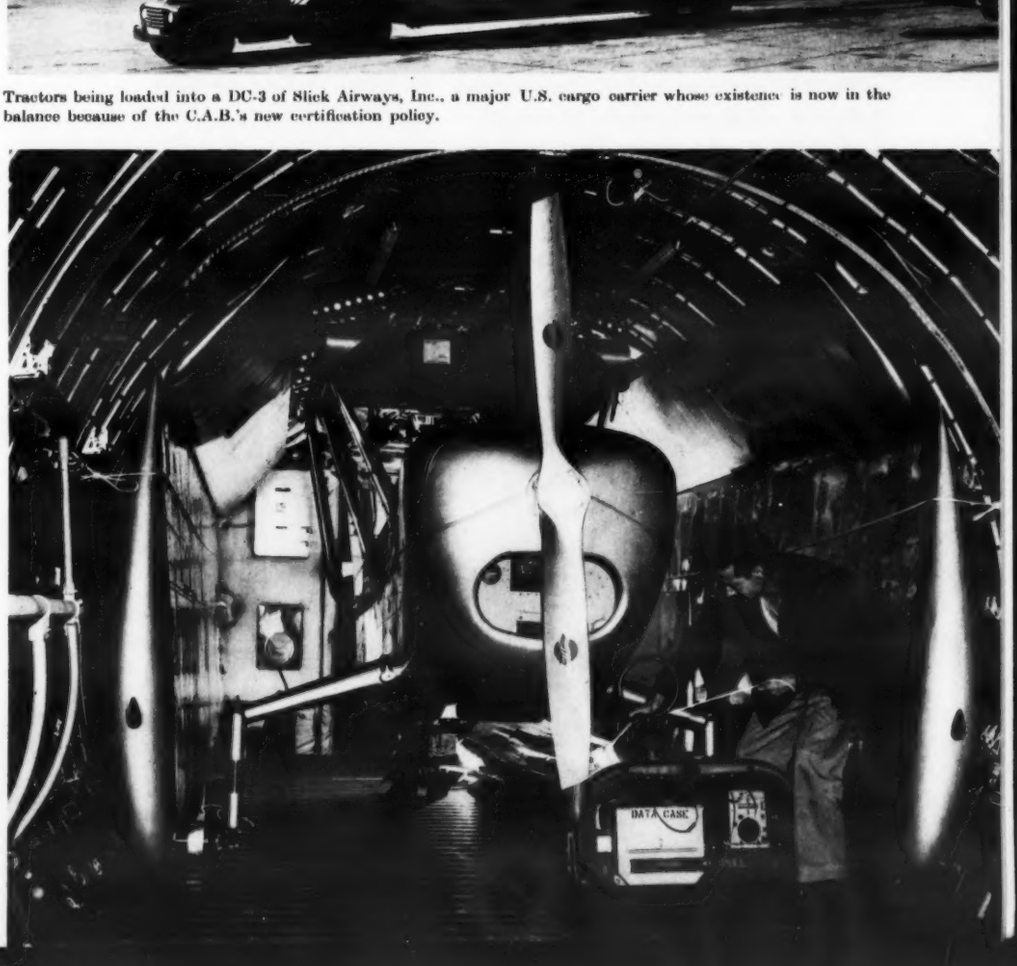
Rail freight from California requires ten days or more to reach the U.S. East Coast, whereas air freight enables perishables to be retailed in East Coast markets 24 hours after harvest. Also, each rail car containing 320 crates of lettuce has to carry along 10,000 to 20,000 lbs. of top ice and some 10,000 lbs. of additional ice packed in the lettuce crates. Granted, ice is cheap enough in the United States, but it costs no less to transport it than it does for the lettuce.

The normal way of handling tomatoes during the winter is to pick them green and ripen them after they reach northern markets. By picking the tomatoes when vine-ripened, and airfreighting them overnight, the ripening cost of 2 to 3 cents per pound can be eliminated.

As lettuce has to be packed with ice for rail shipment, it cannot be packed directly into containers in the field, but must go to

A Bell helicopter, equipped for crop-dusting, being loaded into a DC-4 at Idlewild, ready for being flown to Paris.

Tractors being loaded into a DC-3 of Slick Airways, Inc., a major U.S. cargo carrier whose existence is now in the balance because of the C.A.B.'s new certification policy.



This view of a Boeing L-15 "Scout" military liaison aircraft loaded into the upper cargo compartment of a Boeing C-97 "Stratofreighter" shows that ample space remains for carrying tools, spare parts or other commodities.

This cross-country shipment by T.W.A. of Southern Californian celery, of the first prime crop, will command top consumer prices in New York.

packing sheds. Airfreighting makes it possible to dry-pack it in the field and eliminate the expense of going through the shed—thereby saving about 1 cent per pound in handling lettuce. And still more important is that rail-freighted fruit or vegetables can be sorted or processed only at the end of the journey, as the spoilage enroute makes any previous preparation a waste of effort. (Losses incurred by spoilage during the trip are sometimes extremely high. For spinach shipments during the first week of August, 1940, for example, the Department estimated an average loss of 17.7 per cent.) Airfreighted products can be prepared, washed and sorted before being sent, so that the discarded items remain where they fall instead of uselessly increasing the weight of the shipment.

*

The U.S. Department of Agriculture exposed new vistas. It showed that the advantages of air transport, when subjected to unprejudiced examination, were in no way confined to the quicker arrival of the goods. It was not long before various branches of commerce became convinced that the higher freight rates were worth while and ultimately enabled unforeseen gains to be achieved when all the advantages were calculated. Instead of transporting livestock or frozen meat, the dealers started airfreighting fresh meat, thereby confining the freight costs to the net slaughtered weight.

Clothes dealers discovered that, if they airfreighted hanger merchandise like dresses and coats, they could renounce packing items in cardboard boxes and simply hang the goods in the cargo hold of the aircraft. The following tabulation of costs for sending clothes is taken from *Air Transport* of January, 1947, page 40 (it is also contained in *L'Avion Cargo* by F. Serraz, a foremost book on air freight, published in 1948) :

Costs by rail transport :	
Charge for 1,000 lbs.	$135.00
Packing and unpacking	20.00
Fifty cartons	10.50
Express charge for carton weight	20.25
Tape, tissue, string, etc.	1.00
Total	$186.75
Costs by air transport :	
Charge for 1,000 lbs.	$147.10
Packing and unpacking	0.95
Charge for racks	11.03
Charge for 1,250 hangers	11.47
Pickup and delivery	8.65
Total	$179.20

This calculation, moreover, leaves one factor unaccounted for, which every reader will easily be able to appreciate if he has had a little experience of the vicissitudes of cramming clothes into suitcases and cabin trunks.

Silk merchants, perfume manufacturers, poultry farmers and radio dealers—the most varied branches of commerce began to make similar calculations. (A complete list of goods sent by air may be found in *Le Transport Aérien* by R. de Castillon St. Victor, Paris, 1947, pages 202 *et seq.*) And it would appear that they arrived at promising results, for the revenues from the air freight business in all countries doubled, trebled and quadrupled in the years 1947 and 1948.

At the beginning of last April the U.S. Civil Aeronautics Board released the following traffic statistics for the 16 U.S. domestic trunk airlines :

	1948	*1947*
Revenue miles flown	316,276,359	311,879,430
Revenue passenger-miles	5,822,540,000	6,010,628,000
U.S. Mail ton-miles	37,509,922	32,787,825
Express ton-miles	29,768,883	28,533,362
Freight ton-miles	*70,437,811*	*35,213,590*

Here it should be noted that the corresponding number of freight ton-miles in 1946 was only 14,822,325, and that this four-fold growth of the airfreight business was attained during a year in which passenger trade fell appreciably.

K.L.M. Royal Dutch Airlines announces a 50 per cent. increase in airfreight revenues for 1948 ; the British airline corporations have reported a 53.5 per cent. augmentation. The Australian carriers reported an 88.6 per cent. gain over the 1946-47 period. Air France flew 2,106,170 freight ton-miles in the first half of 1948, against 1,738,000 ton-miles during the same period of 1947. And the corresponding figures for the French private carriers amount to 4,729,500 and 1,317,080 ton-miles for 1948 and 1947, respectively.

Who said that aircraft were suitable for carrying only light freight ? This photo shows a 9,000-lb. rotor for a steam ship's main generator being unloaded at Basra, Iraq, after a 6,500-mile flight from New York. It was for repairing a tanker of Standard Vacuum Oil Co., who estimated the disabled vessel was costing $4,800 daily while idle ; the transportation would have taken five weeks by ship.

Dividing up the cake

Cheerful as this soaring of the airfreight business is, it is unfortunate that its progress is not being fostered by hard competition. Viewed historically, the bitter feud between the scheduled and non-scheduled airfreight carriers is not at all surprising. A similar tension has existed between regular and tramp

shipping since the earliest days of the steamship. The regular shippers held numerous conferences in order to come to tariff agreements. But each new boom resulted in a new advance for tramp shipping and led to rate cutting which gave the regular shippers many a headache. During the major shipping crisis of the thirties, the regulars urged a temporary but compulsory laying-up of a large number of tramp steamships, but this plan was rejected by the International Shipping Conference (Memorandum, Transport Section of the League of Nations, January 16th, 1934).

Non-scheduled air transportation began to take shape after the last war, and the trade boom in 1946 led to a rapid flourish of such carriers in the United States and Europe, most of which were operated by ex-air force pilots.

As an example of how these companies developed we mention Seaboard & Western Airlines, of New York, from whom some of the accompanying illustrations originate. The greater part of the executive and flying personnel saw service during the war as pilots and staff officers with the Air Transport Command of the U.S. Army Air Force or with the Naval Air Transport Service. Most of the company's officers served on the famous "Hump" operation which flew millions of tons of military supplies into China from bases in India and Burma. Operations were initiated in May, 1947, specialising in flying freight across the Atlantic, and the air fleet has since increased from one to five DC-4 all-freighters. During the same period the total payroll has grown from 20 to 123 persons.

Today this carrier is fighting, alongside all the other U.S. non-scheduled carriers, for its existence. The U.S. Civil Aeronautics Board is at present conducting a legal battle which is to decide whether the irregulars should, as hitherto, be bound merely by a purely formal authorisation, or be subjected to a real concession. In the latter case the C.A.B. would have to declare that no "public interest" exists in the U.S.A. for non-scheduled air transportation. In other words, the future existence of America's entire non-scheduled air transportation system is in the balance. The decision will probably have been taken by the time these lines are in print, and we shall know whether the air trampers, as they stand today, have to retire in favour of the major scheduled airline companies.

It is not excluded that the U.S. decision may have international repercussions. The attitude of European countries to airfreighting has hitherto been on different lines from the U.S. policy. The Europeans have generally left the irregular carriers in freedom. They have allowed air freight exchanges to arise and consequently enabled variable freight tariffs to develop. The C.A.B., on the other hand, decided in April of 1948 on a standard rate of 16 cents per ton-mile, to which both scheduled and non-scheduled carriers are bound. Meanwhile, it is quite imaginable that Europe may follow suit.

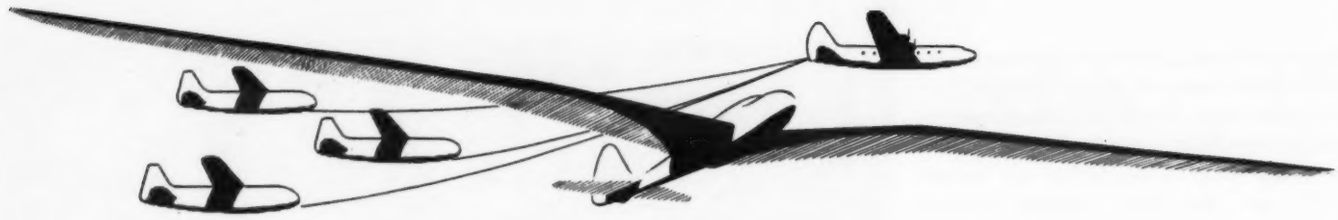
From the international angle, the association of private air carriers, FITAP (Fédération Internationale des Transports Aériens Privés) is in direct apposition to that of the regular airlines, IATA. The clash clearly involves a new formulation of Article V of the Chicago Convention on International Civil Aviation, which involuntarily privileges the non-scheduled carriers in the matter of granting landing rights.

But however the decision turns out, from the international and national standpoints, and whoever operates airfreight services in the future—one thing is indisputable, namely, the transportation of freight by air has risen to such a degree that it now forms an indispensable part of the economic life of all countries.

Pan American World Airways supplies Alaska with fresh vegetables and ... ... fresh milk.

Fresh swordfish is a delicate and highly perishable commodity, but its density and high value make it ideal for airfreighting. The flying Tiger Line carries it regularly from the Pacific to the U.S. East Coast. The low temperature in the upper air levels protects it against deterioration, but refrigerated trucks have to be used for the ground transportation.

An airborne Noah's Ark, in which cows, calves and pigs travel peacefully (we hope !) together.



Powered Sailplanes for Cheaper Flying

BY WALTER M. HORTEN

The fact that the present high costs of private flying as well as of soaring flight constitute a generally insuperable obstacle to the majority of would-be pilots is realised with regret throughout aviation circles. Soaring flight has attained a high level of technical perfection in a relatively short time. Aerodynamicists, constructors and meteorologists have revealed, through cooperative effort, ways of tapping the energy of the airspace which the pioneers of former decades could never have imagined. At present, however, it would appear as though this technique had reached a sort of acme. But the lack of further expansion of this worthy sport is not so much due to any physical knowledge which may perhaps still be undiscovered ; what is really missing is a practical exploitation of the knowledge already available—the development of sailplanes which bring *independent* soaring flight within reach of less well-lined pockets.

The most profitable way of opening this discussion is first to acquaint readers with the shortcomings of soaring flight as it is practised today. To begin with, the soaring pilot wishing to go in for cross-country flying must acquire a roadable trailer, which alone costs a quarter to a third of the price of the sailplane. It goes without saying that he must also possess a motor car for towing his trailer ; but even this does not make him completely independent as far as moving over the ground is concerned : he must further enlist the aid of at least two persons for unloading, assembling, dismantling and loading his equipment. Once he has all this at his disposal, he can start thinking of flying. Winch launching and aero-towing are the usual methods of leaving flat terrain on a search for thermals. And as it would never be worth while for a sailplane owner to purchase his own winch installation—not to speak of his own tug aircraft—in order to be able to go soaring, he has to join a club and make use of whatever facilities it provides. Being dependent in this way is frequently very inconvenient, and again involves extra expenses. Hence, the majority of sailplane pilots prefer to charter a tug aircraft ; and they are unfortunately right in maintaining that, in this way, they can fly longer and have more fun for their money. Clearly, therefore, the way in which soaring is practised nowadays involves expenses ridiculously out of proportion. As a matter of fact, the writer witnessed one case where it had been calculated at the end of a year that each hour of soaring had cost five times as much as one hour in a 100-horsepower personal aircraft would have cost. Furthermore, it should not be forgotten that a large part of the time is, in a way, wasted in getting hooked up to the tug aircraft, or the winch, and looking around for favourable meteorological conditions ; the actual soaring part is short and sweet. Briefly, therefore, soaring flight, as it is carried out today, is a sport for the wealthy.

Is this circumstance an inevitable necessity ? Would it not be possible to arouse again the earlier enthusiasm for soaring, if the number of operational possibilities could be increased and the costs considerably decreased ? If this could be accomplished, soaring would be brought within reach of a much wider class of society.

Well, there is a possibility of accomplishing all this, and it is given by a new type of aircraft—the *powered sailplane*. Meanwhile, it has nothing in common with those constructions generally known under this name, but is an aircraft which can really be used for soaring flight, revealing the same performance (sinking speed, L/D ratio, high-speed characteristics, etc.) as a pure sailplane. Such an aircraft has already existed, though the events of the last few years did not enable it to become widely known : the *Horten IIIg*. An account of the jobs it was designed to perform and of the experience gathered with it, will help to solve the problem.

Of what was the Horten III g capable ? To begin with, it could effect an entirely independent take-off with a run of about 250 feet. Then, its climbing performance, with a maximum rate of climb of 470 ft./min., opened new vistas in airspace exploration, frequently giving the pilot a better chance of finding up-wind currents than when the conventional winch or tug-aircraft method of launching was used. Once an up-wind zone was reached, the engine was cut out ; the blades of the pusher propeller automatically folded backwards so as to eliminate additional drag. Pure soaring flight then proceeded as usual, and the pilot had the additional advantage in cross-country flight that, if the up-winds disappeared for some reason or other, he did not have to make a landing in some remote region, as would be necessary with a normal sailplane. He could at any time start the engine up again and go over to powered flight ; the propeller unfolded itself automatically. This made the pilot independent of eventual changes in the meteorological conditions, and also enabled him to do without a ground team with motor car and trailer for taking him back to base. Furthermore, he was not tied to specific regions enabling emergency landings to be made, but could interrupt his flight at any time and return home or call at another aerodrome. During the tests, flights of over five hours were frequently made, with the engine on for only fifteen to twenty minutes in all.

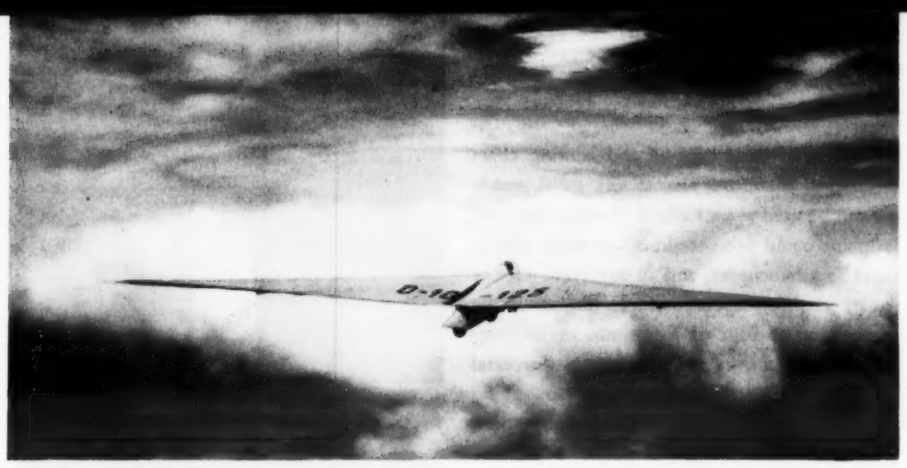
The development of this aircraft goes back to the year 1934, when my brother and I designed and built the Horten II all-wing type of 52 feet span. Even this early design was so conceived as to provide relatively wide limits for the additional weight of an engine. Then, the more advanced Horten III was also designed for realising the idea of a powered sailplane, though with more attention paid to low sinking speed ; it could also be built as a two-seater. Owing to the lack of a more suitable power plant, the H II was fitted with

a Hirth engine of 80 H.P. ; other models were flown as pure sailplanes, as, for instance, the H III type, which defended itself well in the 1937, 1938 and 1939 Rhön competitions. The flying qualities of these all-wing aircraft were improved to such an extent during subsequent years that, on the grounds of their excellent stability, they were acclaimed by foremost pilots as "perfect for blind flying." The advent of war caused further development work to be shelved, until in 1944, when fuel became really scarce in Germany, it was resumed. It was then found that the Model H IIIg, powered with a Volkswagen engine, provided a good means of training pilots on an economic fuel basis. A further factor which stimulated the work was the fact that, at the time, fighter aircraft of all-wing design were not only being projected, but were being tested with success. The production order for the powered sailplane could nevertheless not be executed in view of the trend the hostilities took.

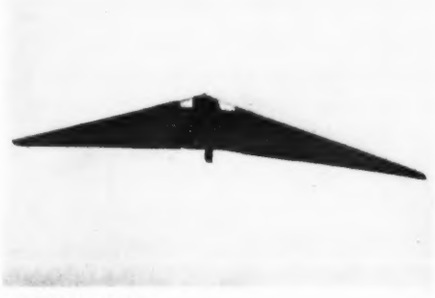
Thanks to structural modifications, the performance of the last version of the Model H III was stepped up considerably. During the test flights it was compared with the best sailplanes available, and it was seen to offer a very good combination of sinking speed and curving radius, and to be always able to make the best use of up-wind zones and to gain the greatest altitude. It seems to have been the right thing to have designed above all a sailplane with good soaring qualities, even though the L/D ratio, in view of the low aspect ratio, was not very high ($C_L/C_D = 24$). The flying speed in thermal flight was low because of the very small wing loading ; the engine had to help for a short while when flying through down-wind areas, in order to increase the speed and improve the "gliding flight."

The experienced soaring pilot will quickly recognise the advantages of such a powered sailplane, and will appreciate most of all its manoeuvrability when seeking up-wind zones. Winch launches only seldom enable thermals to be found ; aero-tows frequently deceive the sailplane pilot, causing him to release the tow rope too early and not to find the anticipated up-wind zone. He almost never has a chance of finding another thermal during the relatively short glide in airfield vicinity, and must consequently repeat the launch. The powered sailplane, however, makes him independent and gives him time to explore the sky until he has found what he wants.

The author does not claim that every powered sailplane absolutely has to be of all-wing design. Clearly, this idea can be realised in other ways. However, a conventional design would require greater technical effort because of the airframe, and also more complicated mechanical procedures for mounting the power plant as it should be mounted in a powered sailplane. On the other hand, the pusher propeller concept is obvious in an aircraft without fuselage and normal tail unit. The downwash area is completely free and the engine is completely housed inside the wing. In consequence, the all-wing design provides a simple solution which is thoroughly satisfactory from the aerodynamic standpoint and is also cheaper than other constructions.



HORTEN II ALL-WING SAILPLANE in tow (1934/38).

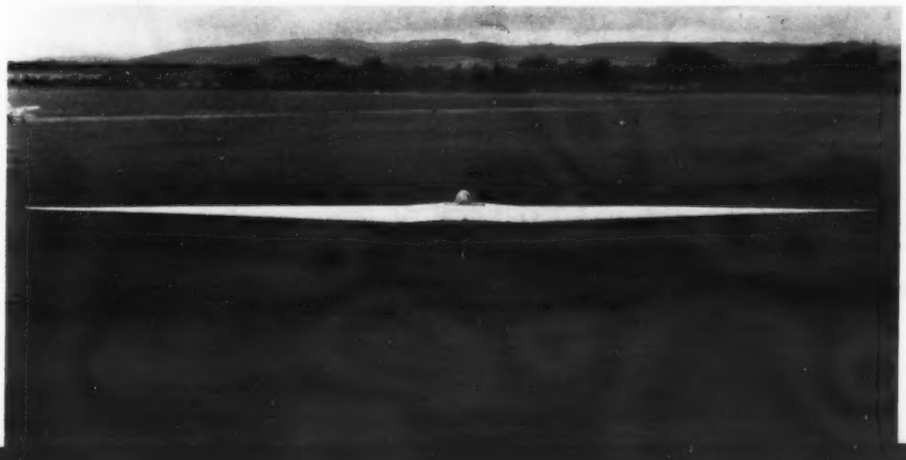


HORTEN II (1938).

The majority of attempts hitherto made to develop an efficient powered sailplane from a normal design of sailplane have failed to lead to the desired result because of aerodynamical shortcomings in the engine installation. Only too often is it to be observed that the inevitable requirement of avoiding supplementary drag when the engine is inoperative, is the snag in powered sailplane design. Moreover, in view of the extra engine weight, the characteristic and necessary aerodynamic features of a sailplane frequently tend to disappear. The result is that the required horsepower becomes too great. The frequently too weak engines are consequently overstrained, undergo severe wear and tear, and work unreliably. And there arises the old criticism : "It is neither sailplane nor aeroplane." Disappointments have been so many that people are wary of the term "powered sailplane." Hence the term should be defined as meaning an aircraft which, with its engine cut out, performs as well as any up-to-date sailplane, and with its engine operative, enables independent take-offs to be made with the aid of a normal two-wheel undercarriage, and furthermore possesses flight characteristics with regard to power reserve, climbing and cruising speed, common to any good light aeroplane.

In addition to this, a powered sailplane can easily be adapted to meet two other, very important requirements—the short landing and the short take-off. As it already has a very low landing speed, it requires only to be fitted with a low, rigid skid to be able to land on a very small area with the undercarriage retracted—thereby needing little more than 60 feet in which to stop, and largely dispensing with the necessity of established airfields. A roadway or lane can be used for the take-off, and a steerable nose- or tail-wheel coupled to the rudder pedals will enable the pilot to keep his take-off run on a straight line. If the initial acceleration is stepped up with the aid of several elastic cables, which can be stretched by the pilot himself, who hooks them one by one to a release device on the nose of the aircraft, independent take-offs can be executed within distances of 60 to 120 feet. Rocket-assisted take-offs would be possible, but might prove unduly expensive.

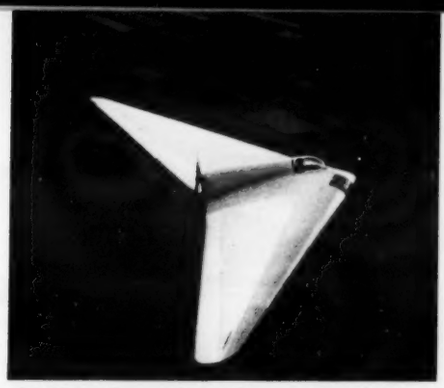
HORTEN IIIb POWERED SAILPLANE (1939).



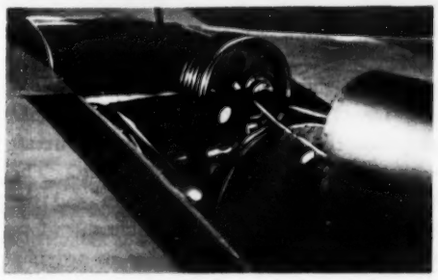
In view of these take-off and landing characteristics, therefore, almost any small meadow can be used as an airfield. Such a powered sailplane could present almost as many advantages as a helicopter, and in any case—thanks to its cruising speed, which can easily be stepped up to four or five times the landing speed—it could be regarded as a universal lightplane. For which really slow-flying aeroplane combines such a low landing speed with such a wide range of available speeds ?

Even though the powered sailplane mentioned here would still be a modern design today, notwithstanding the fact that it was built twelve years ago, it does not incorporate the latest ideas and knowledge. For instance, we now have better engines giving far more power per unit cylinder capacity and weight. Because a folding propeller, for mechanical and statical reasons, always calls for a high reduction gear ratio, the r.p.m. is always low, even if very fast engines are used ; this low propeller r.p.m. speaks for high propeller efficiency. The average power output of modern high-performance motorcycle engines is around one horsepower per cubic inch of swept volume. A single-seater powered sailplane, which would not have to feature a power loading of more than 44 lbs./H.P. to effect independent take-offs, would therefore be fully manoeuvrable if powered with an engine of 22 cu. in. swept volume. If no value is attached to independent take-offs, then 12 H.P., or 12 cu. in. capacity, would suffice for retaining twice the required power as reserve ; the resultant manoeuvrability and climbing performance would satisfy most general purposes.

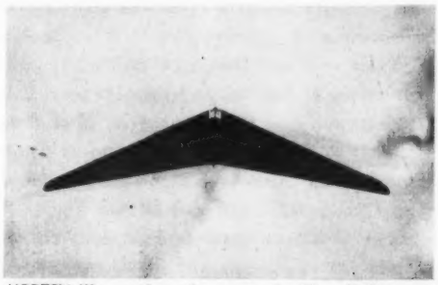
All the above data refer to the existing Horten III type, which no longer represents an optimum design. The adaptation of the airframe dimensions to an up-to-date power plant would entail a reduction of 25 per cent. in required output. Also, the wing area could be reduced from 400 sq. ft. to a considerably lower figure, so that both the engine and the airframe would cost a minimum amount.



HORTEN IIId POWERED SAILPLANE with a 55-H.P. Walter "Mikron" engine (1942).



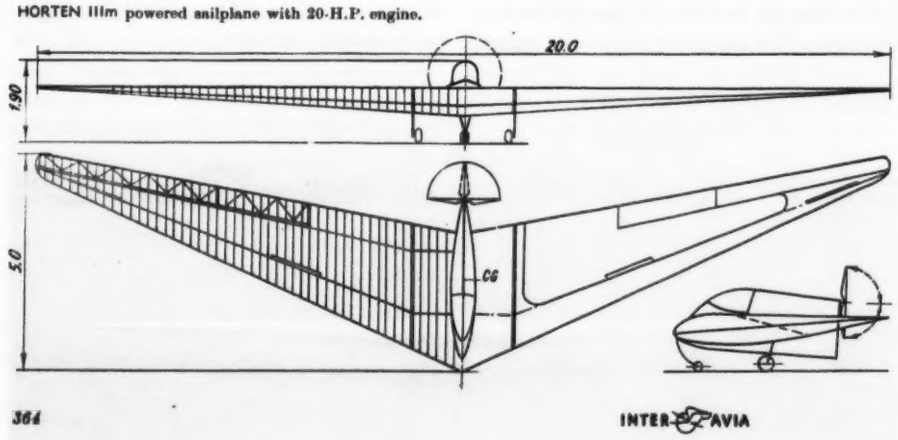
BELT DRIVE FOR THE PROPELLER SHAFT in the Horten IIIe powered sailplane (1942/43). Note the cooler casing of the 32-H.P. Volkswagen engine.



HORTEN IIIg version, also powered with a Volkswagen engine.

FOLDING TWO-BLADE PROPELLER of the Horten IIIg. The axially-positioned spring and a pair of light clamps keep the propeller blades in "soaring" position. As soon as the engine is started, the centrifugal force returns them to normal position where they are held by strong fittings ; this action compresses the spring.

HORTEN IIIm powered sailplane with 20-H.P. engine.



Since all-wing aircraft cost less to build than conventional types, and this difference in cost would roughly correspond to the price of a motorcycle engine, an all-wing powered sailplane could be built for about the same price as a normal sailplane. Clearly, the powered sailplane, which offers a chance of flying at really low costs, is the most attractive proposition.

Horten H IIIm Powered Sailplane

(with 20-H.P. engine)

Characteristics and Performance

Span	65 ½ ft.
Wing area	400 sq.ft.
Aspect ratio	11
Taper ratio	6.4
Empty weight	640 lbs.
Engine weight	66 lbs.
Gross weight	880 lbs.
Wing loading	2.2 lbs./sq. ft.
Min. sinking speed	2.2 ft./sec.
L/D ratio	24 : 1
Landing speed	19 m.p.h.
Engine output	20 H.P.
Max. speed	75 m.p.h.
Take-off run	260 ft.
Rate of climb	8.2 ft./sec.
Required power	4.5 H.P.
No. of occupants	1 (2)

It goes without saying that it should be possible to start up the engine easily and reliably while the powered sailplane is in flight. The engine is generally small enough to allow a kick starter to be used. Battery ignition with a buzzer coil, and injection of ether-type fuels into the cylinder head or the carburetter inlet, would almost entirely preclude faulty starts. If the engine is too hard to turn for a kick starter, a spring mechanism built up from rubber bands wound around a drum could be used ; this could be tightened up easily enough with a ratchet device. Meanwhile, the starting job might also be carried out by compressed air with a cylinder and piston device, or with a small turbine. If expendable cartridges were used to produce the compressed gases, then all that would be necessary to start the engine would be to pull a trigger ; re-loading would also be extremely simple. An electric starter, on the other hand, is excluded because of the necessarily heavy accumulator.

Naturally, the powered sailplane concept leaves room for far more discussion—fields of application, structural ideas, other airframe designs, etc. But it requires deeds rather than words and suggestions to convince everybody of the general idea. It is the writer's hope, therefore, that the present article will contribute in some small way towards the practical realisation of this new type of aircraft, which many must surely have thought of from time to time and which would certainly help to bring flying within reach of far more people.

Turning a Compliment into a Compliment...

Compliments which, for some reason or other, fail to be complimentary we dislike more than outright home truths, no doubt because usually we don't know exactly to what point they are calculated and how much of them is accidental : as a result we don't have a ready come-back, feel vaguely flattered and vaguely annoyed . . .

A smart feat of turning a left-handed salute into a compliment was performed in April by the Douglas Aircraft Co., the Californian aircraft manufacturing concern. This is how it came about :

American Airlines, the largest U.S. domestic air transport operator, was retiring the big fleet of Douglas DC-3 aircraft which it had been using to great advantage for the last twelve years. To say good-bye to its workhorse and announce the latter's replacement with "Convair-Liner" aircraft—in addition to the long-range Douglas DC-6—American Airlines thought up a pretty one-page advertisement and published it in the "Saturday Evening Post," page 72. The advertisement said : "This month A GRAND OLD PLANE makes its last flight !" It also pictured an obsolete "Wild West" stage-coach rocking along a runway beside a DC-3 just off the ground, and continued : "Outmoded by finer, faster, more modern transports, the DC-3 is . . . . being retired . . . to make way for progress . . . The Douglas DC-3 will doubtless continue to serve the public in a limited way, just as the old Ford Tri-motor did, but no longer will it be seen on American's far-flung routes where it starred so long . . ."—Altogether, a nice way of wishing one farewell.

So far, so good. But people in the airline industry first chuckled, then watched with much interest. For, on pages 90 and 91 of the same issue of the same magazine, right across the entire double spread, Douglas Aircraft Co. announced its new, improved version of the same type, fitted with re-designed wing and tail, more powerful engines, etc.

The Douglas ad said :

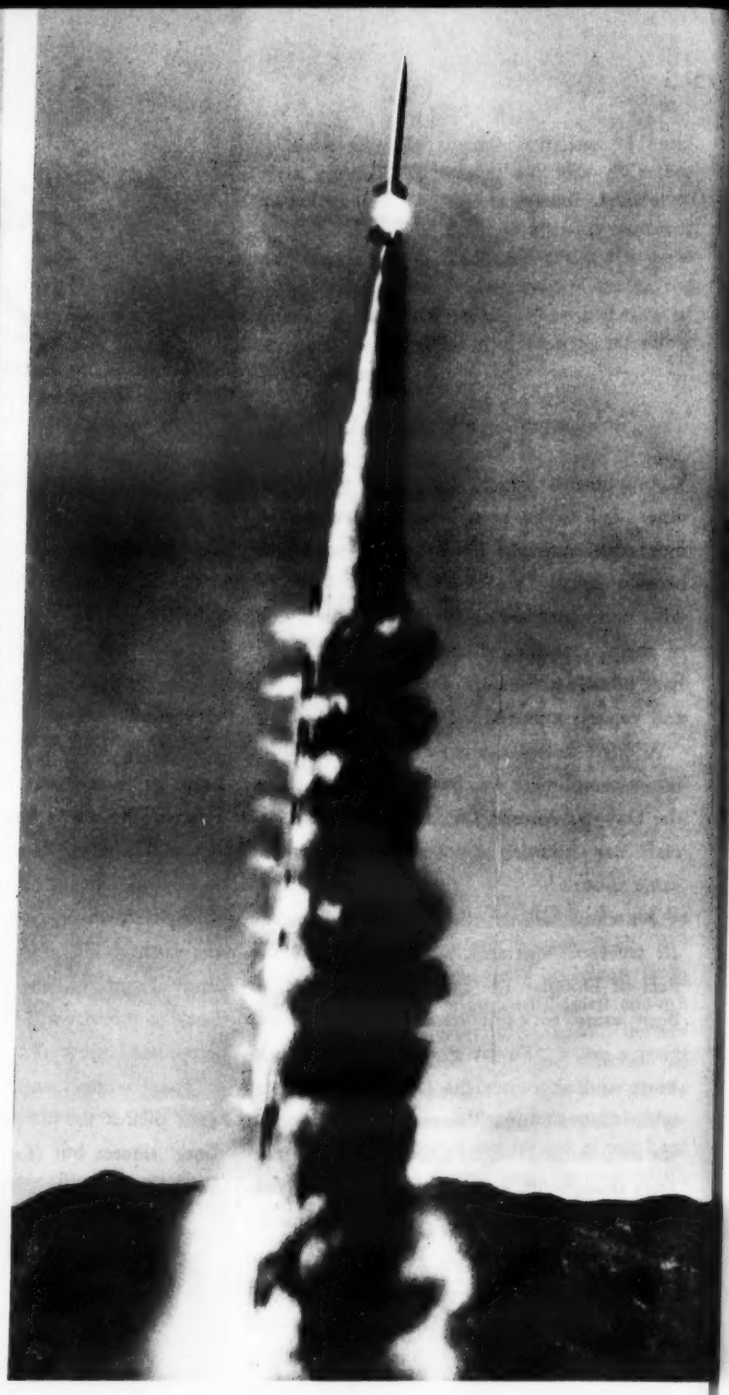
"SWIFT NEW MODEL of a rugged old friend . . . the Douglas Super DC-3 ! As new as tomorrow !"

A general air of expectancy . . . American's advertising experts had obviously failed to keep in touch with Douglas' advertising experts. Result : a head-on collision between Cyrus R. Smith, President of American Airlines, and Donald W. Douglas, President of Douglas Aircraft . . . one company comparing the faithful DC-3 to a stage-coach and the Ford Tri-motor, the other describing it as "new as tomorrow." Some people anticipated suppressed fireworks.

There weren't any. Deftly, Douglas Aircraft picked up the pieces of American Airlines' sincere but (for Douglas) badly timed compliment. When it was put together again it blossomed out in its new form in a number of newspaper display advertisements a few days later.

"THANK YOU, MR. SMITH . . .," said Douglas. ". . . We are grateful to you and your associates for your public tribute to a great airplane, the Douglas DC-3 . . . Folks who use and trust this sturdy workhorse will be glad to learn that in a few months the Douglas Super DC-3, 'a swift new model of a rugged old friend,' will also be available for routes and services requiring better performance . . ."

Slick, hm ? Turning a compliment into a real compliment ! Undoubtedly behind the Douglas *touché !* was the master-minding of A. M. Rochlen, Donald Douglas' *alter ego* and Director of Public and Industrial Relations. As a former right-hand reporter for William Randolph Hearst, the famous newspaper tycoon, he has made "Mr. D." the last-word master in many a controversy.



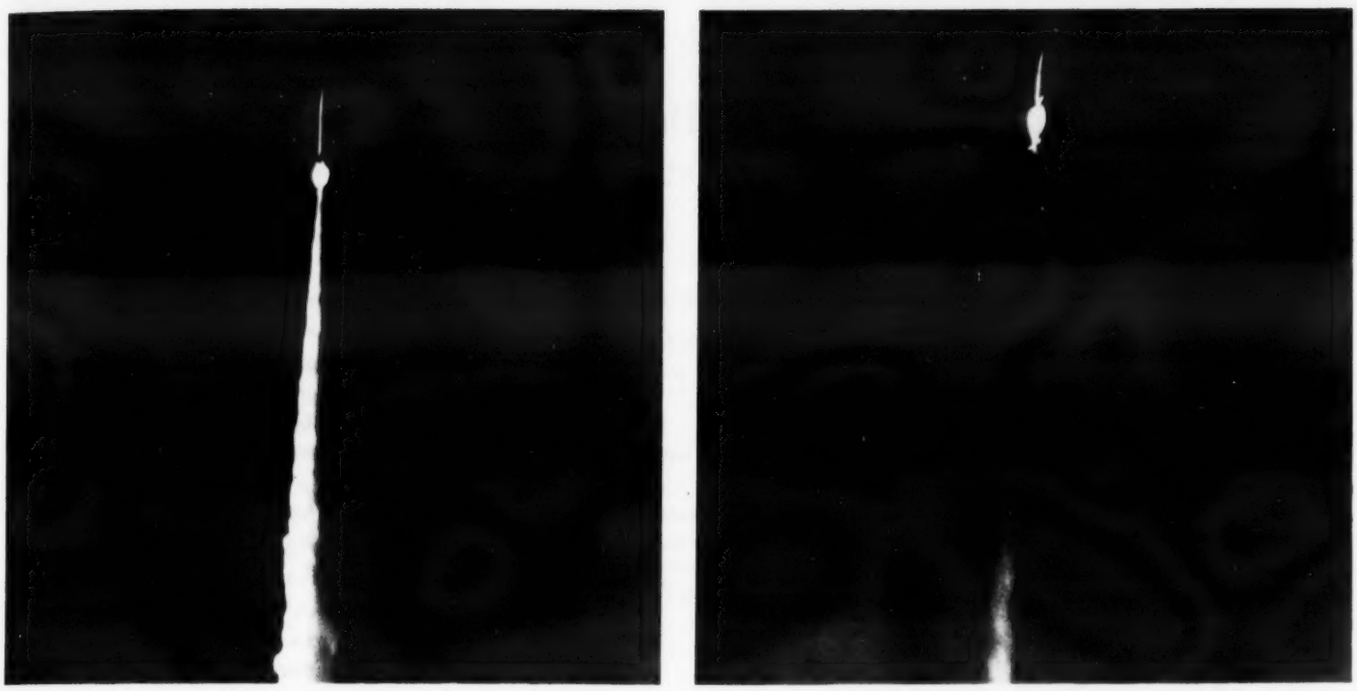
Space Weapons On the Way

The "Aerobee" test rocket

If another war were to break out tomorrow, soldiers and civilians would wait in vain for the appearance of the announced new instruments of warfare—the remote-controlled space weapons for destroying enemy industrial and trade centres and main cities. The idea of the commander-in-chief seated at a control panel in a fortified H.Q. deep under the earth, manipulating buttons and levers to fire and teleguide space rockets, is and will probably remain a whimsical speculation. We shall not bother to ask whether the magazines whose graphic artists and reporters are playing on this sensational theme without the slightest compunction, are rendering a service to humanity with their "explanations."

Granted—there are today laboratories in all major countries, where research work is proceeding on such space weapons. And from time to time a few specially good pictures of test firings are released, which bear witness to the progress being made in tireless research.

In reality, we are today no further than the threshhold of a developmental period. For decades to come, we shall have to collect, patiently and meticulously, all those stones which, one day, can be assembled into the technical prerequisites for a real robot space weapon. A long way, along which the first learner steps were made in recent years. Rocket missiles can be manufactured and, already during the last war, such a construction, the V-2, was developed to a point of perfection which has been but very slightly bettered by present-day research. Experiments to reduce the structure weight—which, in



After simultaneous ignition (left-hand photos) of the take-off rocket (dark smoke trail) and the "Aerobee" test rocket proper, the two-step combination leaves the obliquely-positioned firing ramp. The fuel of the take-off step gives out after a short time, and the two steps begin to separate (right-hand photo).

view of the extraordinarily high fuel consumption of supersonic rockets, is still responsible for their limited range—are being conducted by metallurgists, chemists and thermodynamicists the world over. We are aware of the characteristics of the solid fuels, which are suitable for short combustion periods and a multitude of pacific applications ; we know those of the liquid fuels, and are today in a position to estimate the usefulness of the ram-jet as a means of propulsion for rockets within the atmosphere.

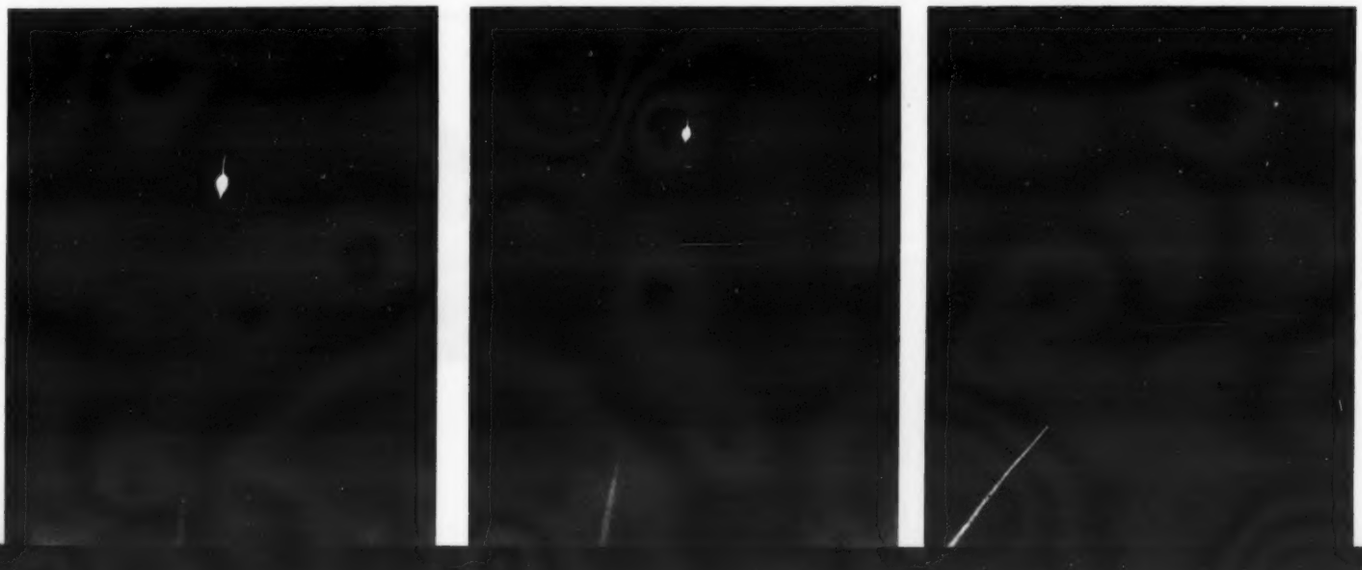
The discovery that a supersonic rocket can profitably be equipped with two independent power units, the first of which serves to accelerate the rocket to the desired velocity and the second to maintain this velocity, has led to the most varied combinations and firing tests. The accompanying photos show, for the first time, a trial launching of the "Aerobee" experimental rocket of the U.S. Navy (it was designed by Aerojet Engineering Corp. and built by Douglas Aircraft Co.), where the rocket element proper and the take-off rocket step (contained in the prolongation of the "Aerobee" and equipped with its own stabilising surfaces) are being fired simultaneously. The two steps separate after a relatively short time.

These tests, too, are destined to furnish new knowledge in aid of further development. Their importance is easily assessed when one takes into account that multi-step rockets are necessary for attaining greater ranges and, notably, for mastering terrestrial gravity with the fuels available today.

The most difficult problem, which could possibly delay the development of reaction-propelled rockets as defensive or offensive weapons, is their remote control. As long as it is impossible to control rockets during their trip, thereby requiring that the trajectory be pre-determined and controlled solely by devices built into the missile, no greater accuracy will be achieved than with the V-2 during World War II. The importance of a true remote-control method is not to be disputed, whether it involves directional beams emitted from the firing station, or direct guidance towards the target by devices built into the rocket, or else the complicated auto-navigation for long-range missiles. With it stands and falls the first really new instrument of a future war in the air : the remote- or self-controlled supersonic defensive rocket—the only means of defence against space weapons.

What progress has been made so far ? Speaking of people who four years ago thought that push-button warfare was just around the corner, an American scientist gave the paradoxical answer that they were "closer to being right than they knew, and much closer to being wrong than they thought."

The take-off step has completely left the "Aerobee," which continues along its trajectory, leaving a dazzling bright trail from its liquid fuel.



Due to an abrupt pull-out...

...the starboard wing leading-edge has broken away.

The aileron follows...

...as well as a piece of the starboard fin...

...whilst the aircraft rolls on to its back...

...and finally...

cracks up completely.

Crack-Up at 500 m.p.h.

This series of photos, taken towards the end of 1944, shows the dramatic sequel of events as an experimental aircraft was completely destroyed in flight, causing the pilot's death. The accident occurred during an official demonstration of the first prototype Heinkel He 162 "Volksjäger" fighter at Schwechat air base, Vienna. The demonstration was for the benefit of the top brass of the German Supply Ministry, which was on the point of launching a "Volksjäger" (People's Fighter) programme involving an astronomical number of units.

It would appear that the aircraft was pulled out of a dive too brusquely, first causing the starboard wing leading-edge (wood structure with 4-mm. plywood skin) to break off at the main spar. It can be seen as a vague shadow in the second picture. Next came the starboard aileron, presumably after the pilot had attempted to check the rolling motion that had arisen in consequence. It can be observed that the starboard fin-and-rudder unit also began to disintegrate. After a right roll came the final act as the aircraft flew apart within a few seconds.

The prototype was not equipped with the pilot-ejecting seat (actuated by an explosive cartridge) foreseen for production models, so that the pilot had no way of overcoming the high angular accelerations and ram pressures in order to bale out.

Despite this accident, the "Volksjäger" was put into production, though only about 200 units were built up to the time of the German collapse. Blueprints and half-finished aircraft fell as booty to the Red Army ; a few complete types came into possession of the Western Allies. Designed specially for mass production from the cheapest and commonest materials, the serial model of the He 162 featured the following characteristics : one-piece wooden wing of only 23 ft. 8 in. span ; light-alloy flaps and tail unit, though with fins of wood ; semi-monocoque fuselage 29 ft. 9 in. long, of light alloy, with "trimmable" tail-cone for adjusting the tailplane incidence; retractable nose-wheel undercarriage ; pilot-ejecting seat. The power plant could be either a BMW 003 E 1 or a Heinkel-Hirth 011 turbo-jet, delivering 2,860 lbs. static thrust ; maximum fuel capacity was 208 Imp. Galls. of Diesel oil. The armament comprised two machine-cannon of 20 or 30 mm. calibre, with either 120 or 50 rounds per gun. At a normal all-up weight of 5,480 lbs. and with its wing area of 120 sq. ft., the He 162 attained maximum speeds of 490 m.p.h. (sea level) to 520 m.p.h. (20,000 ft.) ; it climbed to 19,700 ft. in $6\frac{1}{2}$ minutes, to 36,000 ft. in 20 minutes, and landed at 105 m.p.h.

A Heinkel He 162 "Volksjäger," equipped with a BMW turbo-jet, photographed at a British air base.

Official Bulletin of the F.A.I.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE, PARIS

Further Supplement to the 1949 Calender of Events *

1st CATEGORY (Absolute priority of date) :

July 30th to August 1st : National Air Races of Great Britain, organised by the Royal Aero Club, at Elmdon aerodrome, Birmingham.

These races will include a number of speed and handicap competitions, open to aircraft of all nations.

* See INTERAVIA, Review of World Aviation, Vol. IV, No. 4, p. 222.

Records homologated by the F.A.I.

CLASS C

Light aircraft, 1st Category *(6.1 to 9 litres capacity)*, Light aircraft of 1,000 to 1,750 kgs. gross weight *(new category)* :

Distance in a straight line (U.S.A.)

William P. Odom
Beech Model 35 "Bonanza" monoplane
Gross weight : 1,652.437 kgs.
Power plant : Continental 5-185-1 of 7.72 litres
From Honolulu to Teterboro (New Jersey)
March 7-8th, 1949 *7,797.920 kms.*

CLASS D

1st CATEGORY (single-seaters) :

Duration (France)

Guy Marchand
Nord 2000 sailplane, No. 52
Romain-les-Alpilles
16-18th March, 1949 *40 hrs. 51 mins.*

Book Reviews

Hélène Boucher. By Paul Thorasal. Editions J. de Gogord, Paris.

A short biography of the young French woman pilot who disappeared in tragic circumstances on November 30th, 1934. Almost an autobiography : the author has mainly used the personal records of his heroine to tell his moving but simple story. His principal aim is to reveal, particularly to the young people for whom 1934 is a long time ago, the character and personality of Hélène Boucher, and her example : be great in hardship, humble in joy, and always straightforward, good and courageous. (French.) *J.*

A la mesure du Ciel. By Daniel Lacker. Editions Chantal, Paris, 1948.

At a time when the airliner is becoming just as banal as the steamship, it is good to remember the *ses triplex* which, like the first man who committed a frail bark to the cruel sea, the first conquerors of the sky had, too. Mr. Lacker acquaints us with four such "cavaliers of the sky"—a record pilot, a test pilot, a Free French aviator, and an airman in a political prisoners' camp. His succession of stories is meant to prove, and does prove, that the conquest of the sky has given birth to men of proportional greatness, endowed with a particular type of courage which cannot be dominated by any sort of danger, be the latter connected with the record or test flight, the hazards of the maquis or the hardships of the prison camp. (French.) *J.*

La Radio-Navigation aérienne — Réalisations et Perspectives. By P. Gaudillère. Dunod, Paris, 1949.

The author, who heads the radio navigation laboratory of the Philips Co., concludes his book by saying that "aeronautical radio navigation is still in full growth, and notwithstanding very interesting achievements . . . is far from having reached the stage where certain basic principles have been definitely decided on."

By sorting out the essential principles and separating the problems of aeronautical radio navigation, Mr. Gaudillère makes a worthy contribution to the efforts being made throughout the world to simplify and standardise the systems and methods in this particular branch of aeronautics. The first part of the book is devoted to a description of the problems occasioned by air navigation, defining the most important notions and briefly explaining the radio-electric techniques (wave characteristics, transmitting methods) and the general methods of measuring (direction-finding, ranges, beacons, distance-measuring equipment, hyperbolic systems). The second part deals with the procedures of present-day radio navigation and compares the systems now used, with those proposed and with the suggestions of ICAO—this for long- and short-range navigation and for approaches. The third part is concerned with the future of radio navigation : fundamentals of the problem, qualities of the systems, position-finding, navigational assistance, anti-collision devices, automatic systems.

The book is profitable reading for all who are interested in aviation, and will be greatly appreciated by those wishing to specialise in this particular domain. There are 245 pages, 123 diagrams and two tables for performance comparison. (French.) *Rb.*

Thermocinétique. — By Pierre Vernotte. No. 224 of the "Publications scientifiques et techniques du Ministère de l'air." Distributed by the "Service de documentation et d'information technique de l'Aéronautique," Paris, 1949.

Just as, in mechanics, dynamics cannot be grasped without a previous clear understanding of kinematics, the study of thermodynamics, which is of extreme importance in many domains of aeronautical science and not least in the theory of flow, should logically be preceded by a thorough comprehension of "thermokinetics," the theory of thermal motion. Unfortunately, however, this is all too often overlooked—a hiatus which makes itself evident in the choice of incompatible hypotheses in thermodynamics and flow-theory experiments and also in the misinterpretation of the results of the experiments.

The author of this book has assigned himself a task of fundamental originality : to investigate the thermokinetic processes with his pupil and reader, and cause the latter to view the usual research methods of thermodynamics with a more critical eye. It suffices to page quickly through the book to realise that it conveys not merely dry knowledge but real understanding ; and this is further aided by the author's lively methods of explanation. (French.) *T.*

The Month in Review

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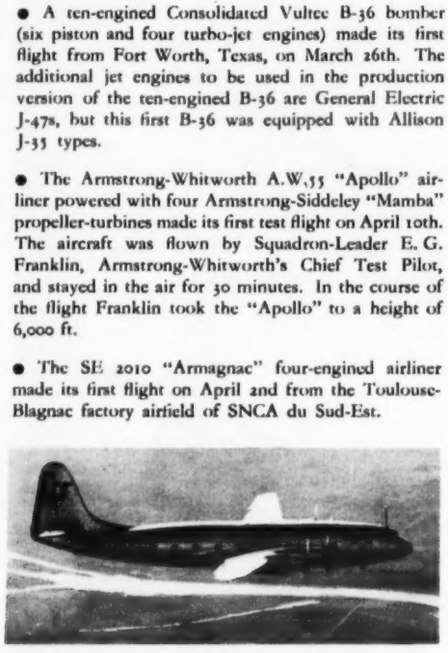
FIRST FLIGHTS

● A ten-engined Consolidated Vultee B-36 bomber (six piston and four turbo-jet engines) made its first flight from Fort Worth, Texas, on March 26th. The additional jet engines to be used in the production version of the ten-engined B-36 are General Electric J-47s, but this first B-36 was equipped with Allison J-35 types.

● The Armstrong-Whitworth A.W.55 "Apollo" airliner powered with four Armstrong-Siddeley "Mamba" propeller-turbines made its first test flight on April 10th. The aircraft was flown by Squadron-Leader E. G. Franklin, Armstrong-Whitworth's Chief Test Pilot, and stayed in the air for 30 minutes. In the course of the flight Franklin took the "Apollo" to a height of 6,000 ft.

● The SE 2010 "Armagnac" four-engined airliner made its first flight on April 2nd from the Toulouse-Blagnac factory airfield of SNCA du Sud-Est.



SE 2010

● The SO 8000 long-range carrier-borne fighter prototype made its first flight on April 1st at Orleans-Brécy. The aircraft is an all-metal low-wing monoplane with twin fin-and-rudder unit and a retractable nose-wheel undercarriage. The power plant is a Junkers Jumo 213 twelve-cylinder in-line engine specially converted by the Arsenal de l'Aéronautique, driving a pair of contra-rotating Chauvière four-blade pusher propellers.

● The NC 211 "Cormoran 1" took off from Villacoublay on April 9th for its first flight. After being in the air for little more than one hour, the aircraft was flown to the Brétigny Test Centre for further flight trials.

● The prototype of the TE-1 single-seater light amphibian, designed by the Finnish engineer T. Eklund, recently made its first test flight. The aircraft is due to go into production, but it is not yet known which firm will take on the assignment. The single-seater version is expected to sell for about Fin.Mk. 400,000, and a projected four-seater version may be priced at Fin.Mk. 1,500,000 to 2,000,000.

NEW AIRCRAFT

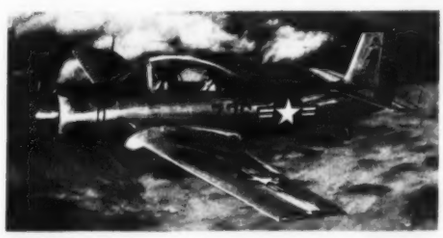
● Lockheed Aircraft Corp. announces a further increase in the maximum take-off weight of the L-749 'Constellation." This increase is for the Model L-749A-79 fitted with new Curtiss 830 paddle-blade propellers and modified propeller hubs. Maximum take-off weight is increased from 105,000 lbs. to 107,000 lbs.; maximum landing weight unchanged at 89,500 lbs., permitting use of the "Speedpak" cargo container at any load-factor up to ranges of 2,200 miles. Operation of the L-749A from high-altitude airports will be possible at a gain of approximately 12 per cent. in payload as compared with the L-749, or, for the same load, at approximately 22 per cent. less runway.

● Lockheed Aircraft Corp. is working on a project involving an experimental aircraft with a variable-sweep wing. The wing's angle of sweep-back is to be adjustable in flight.

● The production version of the Boeing XB-47 "Stratojet" six-jet bomber is to be subjected to certain structural modifications, including stiffening of certain elements, and measures to permit a greater fuel capacity, which will enable the aircraft's gross weight to be increased from the present 125,000 to about 200,000 lbs.

● One of the ten existing Northrop B-35 all-wing aircraft (normally equipped with four reciprocating engines) will be fitted experimentally with two "Turbodyne" (XT-37) propeller-turbines of 10,000 shaft horsepower and four General Electric J-47 turbo-jets.

● The U.S. Air Force has chosen as its future standard primary-basic trainer the Fairchild T-31 all-metal, low-wing, two-seater single-engined aircraft. The T-31 will be built at Fairchild's Hagerstown, Md., plant and should be in full-scale production in about ten months. The present order calls for the manufacture of 100 units. It is believed that this order may be followed by contracts for a considerably higher number of machines, although Fairchild has so far made no official statement on the matter.



Fairchild T-31

● Bell Aircraft Corp. announces the Bell 47D1, a new general-purpose helicopter designed to carry three occupants and a payload about 40 per cent. above that of previous models. It can be equipped with floats; crop-dusting, spraying and fogging equipment can be added; and it can carry stretchers for rescue work. Night-flying instruments, two-way radio and a hydraulic rotor brake are part of the standard equipment.

Bell 47D1

● Vickers-Armstrongs Ltd. announces a new model of its V.C.2 "Viscount," known as the "Viscount 700." It is fitted with four Rolls-Royce "Dart 3" propeller-turbines of 1,400 shaft horsepower and separate versions thereof are to provide accommodation for 43 and 53 passengers. The span is 94 ft., length 81 ft. 2 in. and wing area 963 sq.ft. Take-off weight is given as 48,000 lbs. Cruising speed is 328 m.p.h. at 25,000 ft. on 68 per cent. power; the take-off distance over a 50-ft. obstacle in still air, to ICAO requirements, is 1,375 yards.

● The Westland "Wyvern TF.2" strike fighter has been released from the secret list. Power plant consists of an Armstrong Siddeley "Python" propeller-turbine.

● SNCA du Nord is working on the design of a long-range bomber to be powered with two Arsenal 24 H piston-engines and two Hispano-built Rolls-Royce "Nene" turbo-jets. The Arsenal engines would be used for normal flight, the jets to provide additional power for take-off and combat.

● Work is continuing in S.A. Italiana Ernesto Breda's Milan plant on the prototype of the BP.471 twin-engined airliner (for 18 passengers) or freighter (for 7,720 lbs.). The prototype will be powered with two twelve-cylinder air-cooled Isotta-Fraschini "Delta RC. 40 I" Vee-engines, each delivering 800 H.P. for take-off. Use of these engines would allow for a maximum take-off weight of 18,960 lbs., but structural provisions are made for more powerful engines of up to 1,215 H.P., which would increase the maximum take-off weight to 21,160 lbs.

● The first Ilyushin IL-12 Russian-designed twin-engined airliners for C.S.A., the Czech state airline, have been delivered. These IL-12s differ to some extent from the initial aircraft of the type used by Aeroflot, the Russian airline, and exhibited at various trade fairs in Eastern European countries (Poland, Czechoslovakia, Hungary and Finland). The new IL-12 has enlarged vertical tail surfaces, the fin now featuring a dorsal fillet. It is stated that this modification should improve the flying characteristics of the

Ilyushin IL-12 of C.S.A.

IL-12, notably when flying on one engine. Moreover, the C.S.A. IL-12s have an undercarriage of simplified design, a cleaner arrangement of the engine exhausts, increased instrumentation and improved radio equipment. They will be used as 27- or 32-seaters, mainly in the latter version.

● The Polish state-owned aircraft manufacturing research institute (Lotnicze Warsztaty Doswiadzalne) is producing a large series of L.W.D. "Zuch-1" training and personal aircraft. The "Zuch-2," a refined version powered with a 160-H.P. Bramo Sh. 14 engine, will shortly start its flight tests. Development work is proceeding on the L.W.D. "Goniec" (Courier) trainer powered with two 105-H.P. Walter "Minor 4-III"

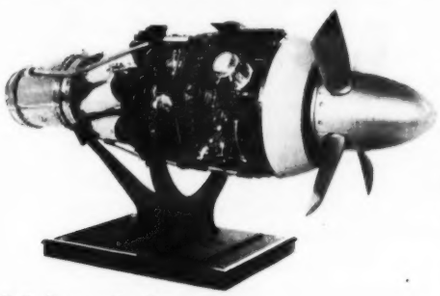
* Excerpts from Nos. 1665-1683 (March 22nd to April 16th, 1949) of "Interavia Air Letter," an aeronautical digest published five times weekly, with photo service, in separate English and French editions.

engines, and another trainer, the L.W.D. "Bies" (Devil). A batch of 20 Piper "Cub" light aircraft are being converted by L.W.D. ; the work includes the fitting of these aircraft with 75-H.P. Czech-built "Praga" engines.

● The Government-owned Hindustan Aircraft Co., Ltd., of Bangalore, is manufacturing three types of aircraft. The HT-2 is a single-engined all-metal low-wing trainer monoplane with tandem seats and was specially developed for initial training under tropical conditions. Two prototypes are under construction and should be completed before the end of 1949. Quantity production should start in about two years. The HT-11 is also a single-engined aircraft but with considerably higher performance. A prototype should be ready for its initial flight tests early in 1951. The third aircraft under construction is the HT-10, an advanced fighter-trainer equipped with an Armstrong-Siddeley "Mamba" propeller-turbine, which is expected to attain a maximum speed of approximately 210 m.p.h. Large numbers of the HT-10 are expected to be in service by 1953.

POWER PLANTS

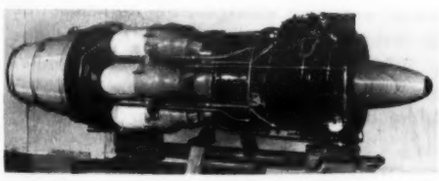
● The Rolls-Royce "Dart" propeller-turbine has been subjected to design refinements which have boosted its power from 1,250 to 1,400 shaft horsepower, and official type tests at this output will start shortly.



Rolls-Royce "Dart"

● The Arsenal H 244 reciprocating engine, which has been developed from the Arsenal 24 H 24-cylinder type, has completed its 200-hour test run, corresponding to a type approval for 3,500 H.P. For flight-test purposes, Arsenal H 244 engines are to be fitted experimentally in a "Languedoc 161" airliner.

● The Avro "Chinook" turbo-jet engine developed by A.V. Roe (Canada), Ltd., consists of a nine-stage axial-flow compressor (compression ratio, 4.5 : 1), six combustion chambers, a single-stage turbine and an exhaust cone. Take-off power is 2,600 lbs. static thrust at 10,000 r.p.m. at sea level ; cruising power is 1,900 lbs. static thrust at 9,500 r.p.m. at sea level.



Avro "Chinook"

INDUSTRIAL NEWS

● The Instituto Aerotecnico de Cordoba, Argentine state aircraft and equipment factory, has concluded an agreement with Rotol Ltd., of Gloucester, under which the Argentine organisation purchases the manufacturing rights to Rotol's propellers and other items of aircraft equipment.

AIR TRANSPORTATION

Intercontinental :

● Pan American World Airways has started thrice-weekly San Francisco—Honolulu and Los Angeles—Honolulu services with Boeing "Stratocruisers." The line also plans to operate two New York—Bermuda services weekly with "Stratocruisers."

● British Overseas Airways increased its trans-Atlantic services on April 1st, following restricted operations during the winter owing to the transfer of the line's Atlantic Maintenance Base from Montreal to Bristol. There are now two flights weekly on the London—Montreal run and a thrice-weekly London—New York service. Additionally, there is a thrice-weekly freight service flown with Consolidated "Liberators."

● K.L.M. Royal Dutch Airlines has increased its Amsterdam—New York schedule from six to seven round flights weekly. On May 16th additional twice-weekly round flights will be introduced, and three of these nine-weekly services will be routed via Shannon and six via Prestwick.

● Trans-Caribbean Airways, the U.S. non-scheduled carrier, plans to operate a monthly service from Colombia and Venezuela to Europe.

● Aerovias Guest, the Mexican carrier, is now operating a twice-weekly Mexico City—Paris service, having extended its Mexico City—Miami—Bermuda—Azores—Lisbon—Madrid route to the French capital.

Africa and Orient :

● Air France opened a weekly Paris—Montpellier—Algiers service on April 11th, thereby incorporating Montpellier on its network for the first time.

● The Brussels—Stanleyville service of Sabena has now been routed via Athens, Cairo and Juba. An additional intermediate landing is made at Khartoum on the return trip.

● Qantas Empire Airways is planning to open a Sydney—Hong Kong service via the Philippines, and a group of QEA officials left Sydney in a chartered DC-4 on March 16th for a survey flight over the route.

● Siamese Airways is planning to expand its international services by inaugurating routes to Shanghai, Rangoon—Calcutta and to Manila.

U.S.A. :

● Trans World Airline is extending its coach service from Kansas City to New York and from Los Angeles to San Francisco. A Kansas City—Los Angeles connection has been in operation for some time. Other U.S. coach services include three night schedules by Capital Airlines over the following routes : New York—Pittsburgh—Cleveland—Detroit—Milwaukee—Minneapolis, Washington—Pittsburgh and Washington—Chicago. Northwest Airlines plans a transcontinental coach service linking New York and Seattle.

● Western Air Lines intends to sell its fleet of six DC-4s and to fly the routes hitherto operated with DC-4s, with "Convair Liners."

● Capital Airlines is opening a Philadelphia—Reading—Williamsport—Elmira—Corning—Rochester—Buffalo service.

Europe :

● British European Airways and the Ministry of Civil Aviation have licensed 17 British charter companies to fly 29 scheduled services in the United Kingdom for periods ranging from a few months to two years. Principal routes authorised are : direct services from London to Leeds, Blackpool, Manchester, Cardiff and Land's End ; to the Isle of Man from Birmingham, Leeds, Manchester, Blackpool, Glasgow and Newcastle ; to Jersey from Birmingham, Cardiff, Leeds, Blackpool and Manchester ; Isle of Wight, from London, Portsmouth and Southampton. There will also be a number of cross-country lines, notably Birmingham—Southampton, Cardiff—Birmingham, Birmingham—Blackpool and Newcastle—Belfast. The following companies are licensed to fly these routes : Lancashire Aircraft Corp., Patrick Aviation, Cambrian Air Services, Sivewright Airways, North West Airlines, Scottish Aviation, Northern Air Charter, Air Enterprises, Somerton Airways, Western Airways, Barclays International Airways, Transair Ltd., Horton Airways.

● K.L.M. Royal Dutch Airlines' summer schedules are mainly characterised by a consolidation of existing services and the introduction of "Convair-Liners" on practically all main European routes. New services to Nice and Milan are being opened. There is to be close co-operation between K.L.M. and Scandinavian Airlines System over routes to Scandinavia and Paris : Amsterdam—Copenhagen—Stockholm is being flown jointly by K.L.M. and S.A.S., with K.L.M. flying the route five times weekly with "Convair-Liners" and S.A.S. twice-weekly with DC-6s ; another joint S.A.S.-K.L.M. service is the Amsterdam—Christiansand—Oslo run, with each company flying it three times weekly. K.L.M. "Convair-Liner" schedules also include Amsterdam—Paris twice daily, Amsterdam—Hamburg thrice-weekly, Amsterdam—Nice—Rome—Athens and Amsterdam—Frankfurt—Milan twice weekly. The Amsterdam—London route is to be flown thirty-four times weekly with passengers and five times weekly (at night) with mail and freight. There are to be thrice-weekly Eindhoven—London and Eindhoven—Zurich connections. In addition to the above services, K.L.M. will continue to operate its usual routes from Amsterdam to Munich, Prague, Geneva, Rome, Tunis, Madrid, Lisbon, Manchester, Dublin, Glasgow, Brussels and Zurich.

● Scandinavian Airlines System's 1949 summer timetable is noteworthy in two respects : the development of a network of feeder services in Germany and Austria, and the increased number of European routes flown in pool with other operators (Copenhagen—Zurich with Swissair and Copenhagen—Amsterdam with K.L.M., in addition to the existing pool services to Warsaw, Helsinki and Prague). Most of the usual summer seasonal services within Scandinavia are resumed, but there are certain modifications : the Stockholm—Oslo service no longer calls at Karlstad and there is a new weekend service from Malmo to Visby. The Norwegian "North Cape" coastal service is resumed : Short "Sandringhams" fly Stavanger—Bergen—Oslo—Trondheim—Bodö—Harstad—Tromsö and a Junkers Ju 52 floatplane continues from Tromsö to Kirkenes via Alta, Hammerfest and Vadsö.

● British Overseas Airways, with Government approval, is purchasing the four Boeing "Stratocruisers" originally ordered by Scandinavian Airlines System (see "Month in Review" in the issue of last month). Together with the six "Stratocruisers" ordered in the U.S.A. some time ago, B.O.A.C. will have a fleet of ten such aircraft, most of which are likely to operate on the North Atlantic. The first of the 22 Canadair DC-4M-4 "Canadair Four" airliners ordered by B.O.A.C. arrived in London on March 29th.

● K.L.M. Royal Dutch Airlines has purchased an additional two Lockheed "Constellations." These will be delivered in August and September, bringing the carrier's "Constellation" fleet to 20 aircraft.

PHOTO CREDITS :

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Marginal Notes

Si vis pacem...

Philosophers and statesmen since the days of the Antiquity have not been able to agree on whether we ought to arm in time of war or of peace, in order to obtain peace. The puzzle of *si vis pacem—para pacem* or *si vis pacem—para bellum* is still unsolved. Our generation can be sure of only one thing : if we prepare neither for war nor for peace, we shall certainly find a war on our hands.

To all appearances this time, the nations, made wiser through painful experience, are making extremely thorough preparations for both. This thought was bluntly portrayed by the U.S. House of Representatives' Appropriations Committee on April 9th when it approved the 1949-50 Defence Budget—the highest since war's end and more than $500 million higher than that requested by President Truman—and commented that America must "prepare for trouble and thereby seek to avoid it."

The U.S. Air Force Secretary, W. Stuart Symington, is backing the USAF's request to Congress for an appropriation of over $300 million for trans- and supersonic research. He has warned that American wind tunnels and research facilities are inferior to those used by Germany in World War II ; these U.S. installations for trans- and supersonic research are totally inadequate to meet "competition among the world powers for supremacy in this new field."

This double-natured preparation has been in evidence in the majority of diplomatic and political negotiations and actions of recent weeks. On the festive occasion of Truman's entry into his fifth year as President of the U.S.A., there was a public reading of his message urging the Senate to ratify the Atlantic Pact. Almost at the same time, however, the House of Representatives and the Senate approved new appropriations for the Marshall Plan, an instrument of pacific reconstruction. From London comes the news that the armed forces of Great Britain, France and the Benelux countries will carry out combined large-scale manoeuvres this summer. But at the same time, the European Economic Council is meeting in the English capital, and the first direct contact between East and West since the rupture of the Moscow Conference of September, 1948, is taking place in Washington.

On April 21st, in Geneva, there gathered 450 delegates and experts from 56 countries to discuss a convention designed to serve the cause of peace in time of war. The various international conventions for the amelioration of the condition of the sick, wounded and prisoners in the armies on land and sea are badly in need of revision. At a time when whole sections of the population can find themselves involved in a war from one hour to another, we must come to agreement on a universal scale with respect to the legal protection of those who—from the factory, the office or the plough—might be called to arms in order to drive off an enemy invader dropping, possibly without a formal declaration of war, from the sky.

Besides all this, the International Committee of the Red Cross has submitted, for the first time officially to Governments, a comprehensive Draft Convention for the Protection of Civilian Persons in Time of War. Among other things it is proposed that there be set up "hospital and safety zones and localities, so organised as to shield from the effects of war the wounded and sick, children under fifteen, expectant mothers and mothers of children under seven, persons over sixty-five." It is suggested that these be marked by means of oblique red bands on a white background, placed on the outer precincts and on the buildings ; the Red Cross emblem would be used only to mark zones reserved exclusively for wounded and sick. (Orange stripes on a black ground have also been suggested.)

The convention will not have shed its draft character by the time these words are in print. But one thing is, already now, certain : Albania, Hungary and the Soviet Union have accepted the invitation of the Swiss Federal Council and are represented at this conference.

A welcome step forward from the cold war to the conference table.

Civil aviation... civil service ?

The Finance Committee of the Danish Parliament recently received a plan for re-organising D.D.L., the Danish airline company, which finds itself confronted by serious difficulties that cannot be overcome without Government help.

The Danish carrier estimates its 1948 losses at 8.8 million Danish kroner. About 18.7 per cent. of its share capital has gone down the drain and it is pleading for a blood transfusion to the tune of 13 million kroner. The Danish state, which had hitherto participated to an extent of 17 per cent., is now to take over 37.75 per cent. of the carrier's stock. In this way the Government will become the principal shareholder and—even if, numerically, it has not the majority of votes—practically has the sceptre all to itself at the board meetings. The private banks and shipping circles, which had hitherto kept D.D.L. on its feet, are retreating into the background.

Viewed externally, the picture of Danish civil aviation will undergo little or no change. But it means that yet another airline company is leaving the camp of private enterprise.

In a way, the transfer to the Government of D.D.L.'s administration is a "private matter" of Denmark alone. Likewise, it concerns solely the Danish taxpayer that D.D.L. has to trace its difficulties and lack of revenue back to economically detrimental exchange, customs and trade barriers erected by the Danish authorities.

Another question—which concerns all of us—is whether there is no way of preventing private initiative from leaving world civil aviation, whether it is inevitable destiny that a private undertaking must become a branch of the civil service—whether civil aviation should be run on a basis of private enterprise or of bureaucracy. And this last question looms up in front of, not only the privately-run U.S. carriers, but just as ominously before a great number of those European airlines in which the governments have become major shareholders.

Addressing the Aeronautics Committee of the Association of the Bar of New York City, on March 23rd, Joseph O'Connell, Jr., Chairman of the Civil Aeronautics Board, expressed "grave doubt" that all the U.S. airlines "have an economic management" or under the present set-up possess an incentive "to finance themselves in the soundest conceivable way. We may seriously and permanently undermine the economic soundness of our transportation system because of the atrophy of the ability of airline management to behave like businessmen."

We would share our regret with the major part of the Western public if world civil aviation ceased to be a counterweight to bureaucracy —if it became the "domestic animal" of the various state administrations and accepted the latters' fiscal measures without criticism because it had lost all feeling for the necessity of balancing a budget.

If matters are to take such a course, the question could one day arise—as paradoxical as it may sound—whether there is any purpose in maintaining the private-enterprise association, IATA, alongside the government body, ICAO. Civil aviation—a branch of the civil service ? No, thanks !

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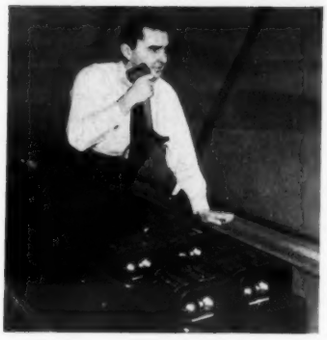

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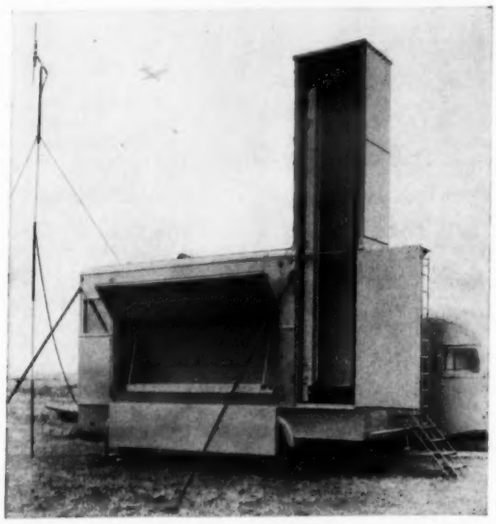

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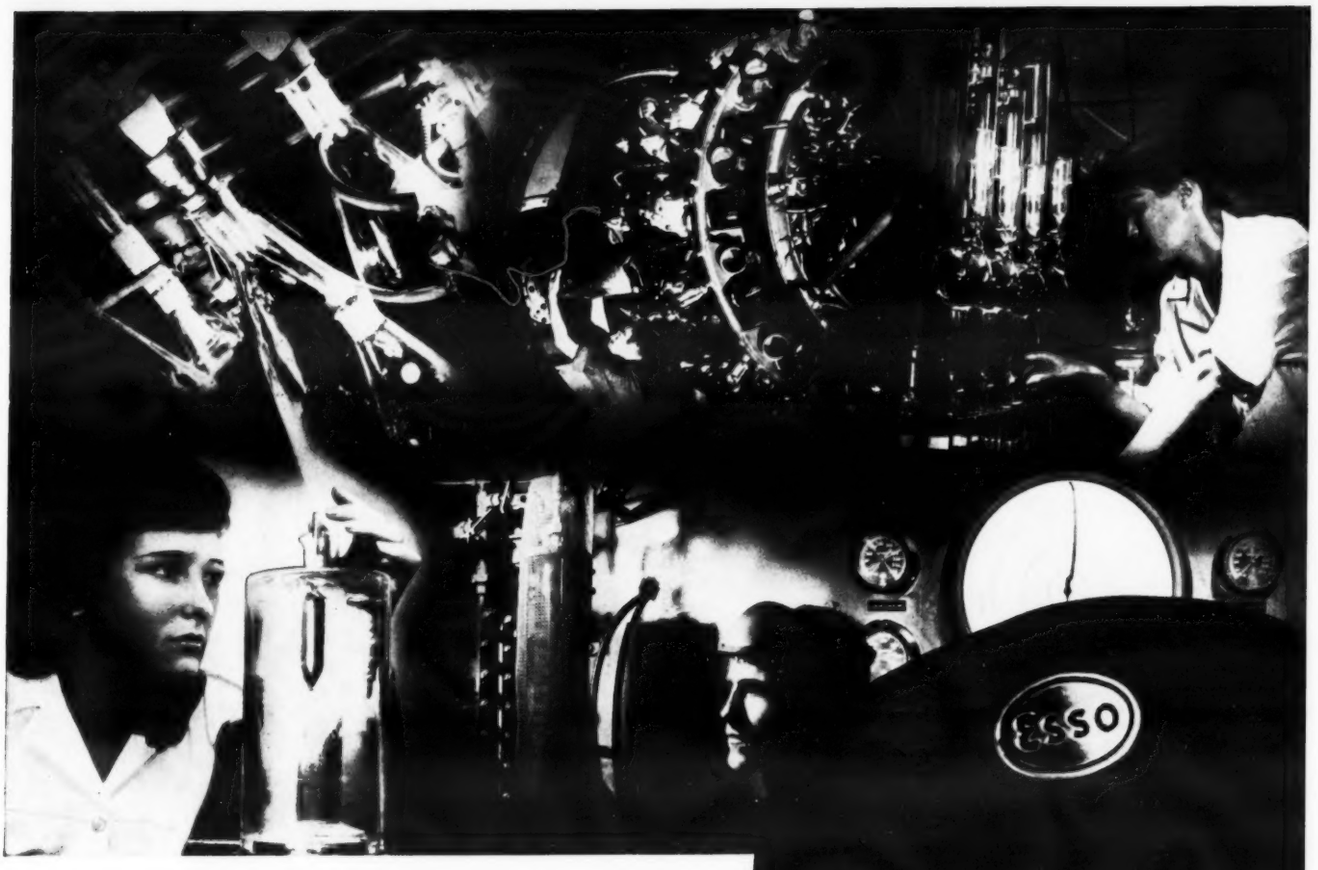

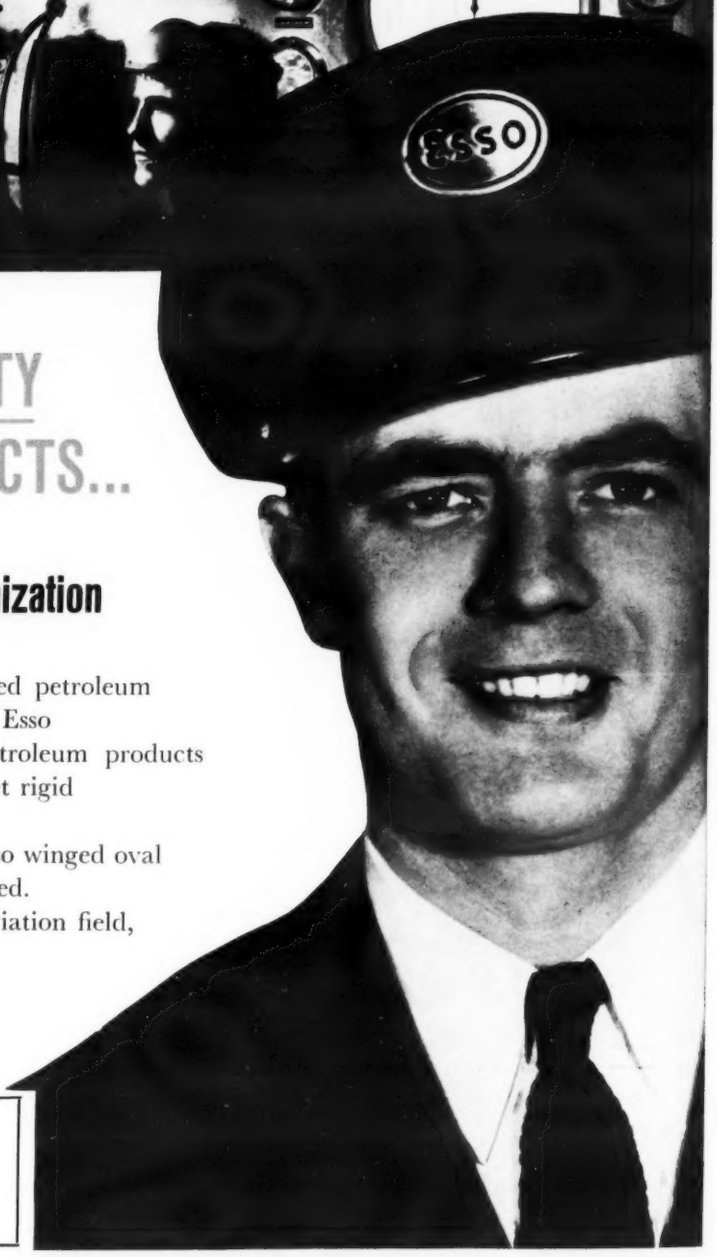

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